Consumer Willingness to Pay for Organic, Environmental and Country of Origin Attributes of Food Products

DISSERTATION

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Abstract

This dissertation examines empirically the values that consumers place on attributes associated with food products that are difficult to verify in the absence of product labeling, including organic, environmental and country of origin attributes. The first essay addresses the impact of product labeling and information treatments on a consumer's willingness to pay for a processed and packaged food through data collected from an online choice experiment. Participants completed five choice experiments in which alternatives varied across four unique attributes: price, country of origin, organic content and environmental friendliness. Participants also faced varying levels of information regarding the non-price attributes. Multinomial and random parameters logit models are used to measure the underlying random utility model preference parameters, which are then used to derive the marginal willingness to pay for changes in attribute levels. It is found that heterogeneity in preferences is significant amongst consumers and that the presence of information regarding product attributes affects both the mean and standard deviation parameters for product attributes. Furthermore, country of origin labeling drives both the highest and lowest WTP estimates, followed by organic content and environmental labeling.

The second essay takes a broader look at WTP estimates for organic foods by use of meta-analysis, where heterogeneity of values observed in the literature is explained by both factual and methodological sources. A total of 29 papers yields 132 observations for analysis and a meta-regression is estimated using percentage premium as the dependent variable and both product and study characteristics as independent variables. Factual heterogeneity explains 65% of the explained variation in percentage premium and includes variables describing the food type under study, year of the sample and sample representativeness. Methodological heterogeneity explains the remaining 35% of explained variation and includes variables describing the data elicitation method and study methodology. It is found that studies investigating organic fruits and organic foods that are sourced from animals have higher premiums, studies using contingent valuation methods have higher premiums, and that the degree of sample representativeness of a study has significant effects on premium estimates.

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Section 1.1 Introduction

Every day millions of consumers enter a supermarket, convenience store, or other venue to purchase packaged food items. These food items can be classified as search, experience or credence goods (Darbi and Karni, 1973). For search goods, the quality of the product is easily assessed before purchase; for experience goods, the quality becomes known after consumption; and for credence goods, the quality is not known before or after consumption (Caswell and Mojduszka, 1996). Thus, for credence goods, a problem of asymmetric information occurs between the producer and consumer where only the producer knows the true quality of the food and consumers only know of the food's quality through labeling (McCluskey, 2000) or information activists (Feddersen and Gilligan, 2001).

In the interest of consumer safety and consumer rights, some labeling has become mandatory such as nutritional information and an ingredients list (see Roe, Teisl and Deans, 2014, for an overview). In the case of organic food products, the U.S. Congress passed the Organic Foods Production Act in 1990, which required that the U.S. Department of Agriculture (USDA) develop standards for foods marketed as organic (USDA, 2008). The National Organic Program (NOP) was created within USDA's Agricultural Marketing Service, and charged with developing the standards for organic foods supplied in the U.S., which includes the monitoring and certification of organic food producers, handlers and processors, as well as certifying imported organic foods (USDA, 2008). In order to identify products that meet the standards set forth by the NOP, the NOP seal was developed as a signal to consumers that the product in question is in fact certified organic, and is in accordance with all organic standards set forth by the USDA.

Organic foods have become commonplace in the American food market. U.S. sales of organic food and beverages have grown from $1 billion in 1990 to $26.7 billion in 2010, and organic sales in 2010 are a marked 7.7% increase over 2009 sales (Organic Trade Association, 2011). To match this increase in consumer demand, organic food suppliers have also increased in number. When the NOP began oversight of certifying organic farmers in 2002, there were 7,323 certified operations, while in 2008 there were 12,941 (USDA, 2008). Furthermore, while organic foods were once only found in farmers markets and specialty stores, in 2010 54% of all organic food sales could be attributed to mainstream supermarkets, club/warehouse stores and mass merchandisers, and only 39% of sales attributed to natural foods retailers (Organic Trade Association, 2011). This indicates that organic foods are reaching an ever wider audience, and thus knowledge of the existence of the NOP seal has also spread. Yet, does the average consumer know of all the provisions the NOP seal carries and, if so, how does this knowledge translate to value?

This essay focuses on a series of choice experiments using a multi-ingredient, processed food product, and organic content, eco-labeling, country of origin labeling and price as the differentiating attributes. The experiment features a between-subjects information treatment regarding organic standards and/or eco-labeling information and elicits measures of willingness to pay for the product attributes. This essay adds to an emerging literature regarding multi-ingredient, processed organic foods and informational treatments to better isolate the origin of value for credence attributes on the purchasing behavior of packaged food products.

With regard to consumer willingness to pay for organic, this analysis reveals premiums much higher than previous estimates in the literature. Batte et al. (2007) measures premiums for organic cereal with identical attribute levels and finds that consumers will pay between 8.4% and 15.1% over the average price of cereal while this study yields premiums between 40.8% and 79.4%. Hu et al. (2011) use the same organic certification levels as this essay and find premiums between 0% and 7.4% for organic jam. Retail prices for organic cereal vary greatly depending on brand, store and location of sale. For certain brands, organic cereal carries no premium when compared with non-organic cereal. Although equal prices can be found between organic and non-organic cereals in the marketplace, retail premiums typically vary between 19% and 176% for organic cereal.

While the willingness to pay for organic content in this essay is generally higher than the previous literature, this study supports the idea that greater organic content drives higher premiums. Batte et al. (2007) used a breakfast cereal labeled with identical organic attributes as this paper and found premiums for organic labeling ranging between

8.3% and 15.1%, while this study reports much higher premiums ranging between 45% and 79%.

With regard to consumer response to improved information, this study reveals that mean willingness to pay increases when consumers are provided explicit information concerning the meaning of the organic or environmental label. In an auction experiment featuring an informational treatment similar to the work in this essay, Gifford and Bernard (2011) elicit willingness to pay for organic and natural chicken breasts both before and after providing participants with information regarding USDA standards for products labeled organic and natural. They find that 50% of participants significantly increased their bids for organic chicken breast after receiving information. In this study, consumer WTP increases by 24% for the highest organic content label, by 23% for the second highest organic content label, and by 13% for the lowest organic content label, after a consumer is exposed to information regarding the USDA standards for organic products.

It is found through this research that positive premiums are also gained through environmental labeling, which supports past work by Loureiro et al. (2002), which shows that consumers are willing to pay more for apples labeled as eco-friendly. The premiums identified in this study range from 43% to 50%, compared to Loureiro et al. (2002) who find a 5% premium for eco-labeled apples.

This work also supports Loureiro and Umberger's (2007) study of beef regarding country of origin labeling, where the highest premiums paid are for products originating in the U.S. Also, this paper concurs with Ehmke et al. (2008) where it is found that consumers prefer products that originate within their own home country. The results of this study identify premiums between 91% and 114% for products of U.S. origin, premiums between 23% and 29% for products of English origin, and negative premiums between 17% and 26% for products of Chinese origin. However, this essay expands upon the current literature by identifying which portion of international supply chains are the source of consumer discounts for foreign products. The results from this essay suggest that the country in which a processed food product is processed and packaged, as opposed to where the ingredients are grown, has the larger effect on consumer purchase behavior.

The results of this paper will better inform the NOP, organic food marketers, producers and retailers on how they can better market organic foods, and how informational treatments affect consumer willingness to pay. The remainder of the essay is organized as follows: section 1.2 is a literature review, section 1.3 describes the choice experiment, section 1.4 describes the data, section 1.5 introduces the econometric methodology, section 1.6 presents results and section 1.7 concludes.

Section 1.2 Literature Review

Organic food products are credence goods in that the consumer cannot readily evaluate if the product in question is in fact organic, before or after consumption. When a consumer goes to purchase an organic food product, they must place some level of trust in either the labeling or the person or business producing and selling the product. Giannakas (2002) finds that "… while certification and labeling are **necessary**, they are **not sufficient** for alleviating organic food market failures." So organically labeled foods may suffer two information failures: 1) organic foods are credence goods and 2) consumers may not fully understand the standards used in organic certification (Giannakas, 2002; Batte et al., 2007; Hughner et al., 2007; Bond, Thilmany and Bond, 2008; Thorgersen et al., 2010; Van Lou et al., 2011; Jannsen and Hamm, 2012). Costanigro et al. (2010) provide consumers with organic label information and scientific information on environmental impacts between bidding rounds in a taste test and auction setting. These authors show that information helps to mitigate uncertainty about credence good attributes and results in value to the consumer. With respect to NOP labeling, Hu et al. (2011) notes that the presence of the NOP seal did not influence product choice, suggesting that consumers may not understand the meaning of the NOP seal without words describing the level of organic content. Batte et al. (2007) found that consumers were willing to pay premium prices for organic foods, even those with less than 100% organic ingredients, and that the presence of the NOP seal increased the probability that a consumer would pay a premium for foods with organic ingredients. Van Loo et al. (2011) found in the market for chicken breasts that the premium for

USDA organic labeling was higher than the premium for a general organic label across all demographic categories, with similar results in the beef market found by Loureiro and Umberger (2007) and in the fresh produce market by Bond, Thilmany and Bond (2008). And yet, all of these papers suggest that consumer information regarding organic labeling is imperfect. As Bond, Thilmany and Bond (2008) suggest, "…observed choices are significantly influenced by the information set available to an individual at the time of response (e.g., the meaning of a logo, the nutritional content of a food, or the relationship between nutritional content and health)."

Batte et al. (2007) estimated willingness to pay (WTP) measures for the NOP seal amidst other organic content signals and product attributes in a choice experiment framework. While the NOP seal was estimated to carry a premium in consumer purchase decisions, it was also noted by Batte et al. (2007) that the NOP has made a significant impact on the organic market even though a majority of consumers have little knowledge of the requirements a product must pass to carry the NOP seal. In related work, Hu et al. (2011) note that consumers may not fully understand the meaning of the NOP label. Additionally, in a 2006 survey, results reported by *Organic Processing Magazine* state that while 56% of respondents were aware of the NOP seal, just 10% of respondents knew the actual definition of the NOP seal, while 43% admitted to having no idea what the seal meant (Demeritt, 2006). Although the NOP seal is designed to communicate several informational elements, a lack of consumer knowledge may exist.

The work reported in this essay introduces informational prompts with the aim to lessen the variation in consumer knowledge of the standards set forth by the NOP. The use of informational prompts in this essay most closely mirrors those used by Gifford and Bernard (2011). However, it differs in that Gifford and Bernard (2011) present USDA requirements for organic and natural foods to all consumers within the study and use a Vickery fifth-price auction to elicit willingness to pay measures, while this essay provides USDA requirements on organic foods to a subset of the total sample and uses discrete choice analysis techniques to elicit willingness to pay measures.

The current essay also assesses consumer willingness to pay for attributes that reflect the environmental impact of the process that led to the production of the food. Labels that communicate these attributes are often called eco-labels (Teisl, Roe and Levy 1999). In terms of eco-labeling, Thogersen (2002) notes that such labels can result in a competitive advantage, which should in turn lead to more eco-labeling on products. In the market for grocery food items, Vanclay et al. (2011) use a three tier labeling system indicating high, medium and low carbon emissions, and collect point of sale data in their experiment. They found that products with a label indicating high carbon emissions declined in sales from 32% market share to 26%, while products with a label indicating low carbon emissions, increased in sales from 53% market share to 56% market share. Although the results in Vanclay et al. (2011) are not statistically significant in aggregate ($\chi^2 = 6.3, p = 0.18$), when low carbon emission products are the cheapest product the results are significant ($\chi^2 = 29.1, p < 0.001$) and marginally significant when low carbon emission products are the most expensive ($\chi^2 = 8.3, p = 0.08$). Grankvist et al. (2004) show that positive environmental labeling influences product choice, and that those who value environmental consequences more were more influenced by environmental labeling. Furthermore, Thogersen et al. (2010) find that buying intentions are positively influenced by environmental labeling in the market for sustainable fisheries.

As with organic content and eco-labeling, country of origin labeling (COOL) research has shown to be a significant driver of consumer purchasing behavior in several studies. Much of the past research regarding COOL in U.S. agricultural markets has been focused on measuring the willingness to pay by consumers for the presence of COOL on products. This focus arises because of the absence of mandatory COOL in most U.S. agricultural markets prior to USDA's 2013 implementation of current mandatory COOL for muscle cuts of beef, lamb, chicken, goat, and pork, and for ground beef, ground lamb, ground chicken, ground goat, and ground pork. Research interest in COOL has also been stimulated by numerous legislative initiatives concerning such labels, including recent unsuccessful attempts to remove COOL language in the 2014 Farm Bill.

Consumer analysis regarding the U.S. beef market by Umberger et al. (2003) and Loureiro and Umberger (2003) suggests that consumers with a preference for COOL and "Certified U.S." beef associated the labels with higher quality and increased food safety (see also Loureiro and Umberger, 2007). Lusk and Briggeman (2009) estimate food values from consumers using a U.S. national survey, and point out that on average food safety is the most important and that origin ranked last in importance. This is contradictory to past research (Mennecke et al., 2007; Loureiro and Umberger, 2007), and suggests that further understanding of consumer preferences for COOL is warranted. Ehmke et al. (2008) finds that consumers from the U.S., China, France and Niger get significantly higher utility from onions that are sourced from their own countries and significantly less or similar utility from onions sourced from foreign countries. Meta research by Verlegh et al. (1999) gives an excellent review of earlier literature and identifies three mechanisms in how COOL influences consumer choice: (1) cognitive, (2) affective, and (3) normative. The cognitive mechanism acts as a signal to consumers of product quality, i.e. Swiss watches and Japanese steel are reputed for their superior quality. The affective mechanism works in how COOL can have an emotional effect on a consumer, i.e. a consumer may feel national pride for products produced in ones' own country or how purchasing Italian clothing can signal social status to others. Lastly the normative mechanism influences choice in that consumers may explicitly purchase (or not purchase) a good because of the country in which the good was produced, i.e. consumers may boycott a product because they do not approve of policies in that country (i.e., voting with dollars). Although it is acknowledged that the 3 mechanisms proposed by Verlegh et al. (1999) do influence consumer choice, I am not concerned with testing effects between these mechanisms in this essay. This essay instead takes a reduced form approach and focuses on how COOL affects consumer choice through the combined effects of all relevant mechanisms.

Section 1.3 Experimental Design

This study employs a choice experiment in which participants are faced with choosing between three multi-ingredient, processed and packaged food products, differentiated by attributes indicated on the products' labels, along with a fourth option to choose none of the options presented. What makes a multi-ingredient food product an appealing target for analysis is that we can measure WTP for organic content over a spectrum of values instead of a binomial "organic or not" label (Batte et al., 2007). Similar to Batte et al. (2007), this paper will consider a breakfast cereal as the product in question for the choice experiment.

There are four attribute categories in which the food products will be differentiated: organic content, environmental impact, country of origin, and price (Table 1.1). Organic content features four levels that are communicated as follows: (1) "100% Organic" and the NOP seal, (2) the NOP seal (indicating at least 95% organic content), (3) "Made with Organic Grains" (indicating at least 70% organic content), and (4) no label. The organic information treatment gives a description of the NOP seal and an overview of the standards that organic producers and processors must adhere to in order to display the label on their product (Figure 1.1). The organic information also explains the circumstances by which a product may claim to be "Made with Organic Ingredients", and states how all internationally sourced ingredients and final goods must be approved by the USDA before they can be labeled as organic. By educating a treatment group of participants in the choice experiment, we will be able to see if WTP measures for organic attributes are significantly higher for those who received the treatment than those

Product = 16oz box of multi-ingredient breakfast cereal	
Product Attribute	Levels
Organic Certification	100% organic (NOP Symbol + "100% Organic")
	At least 95% organic content (NOP Symbol only)
	"Made with Organic grains"
	[blank]
Country of Origin	Processed and packaged in the US with grains grown in the US
	Processed and packaged in the US with grains grown in England
	Processed and packaged in the US with grains grown in China
	Processed and packaged in England with grains grown in England
	Processed and packaged in England with grains grown in China
	Processed and packaged in China with grains grown in England
	Processed and packaged in China with grains grown in China
	[blank]
Environmental Labeling	Presence of Environment friendly seal
	[blank]
Price ($/16 ounce box)	Five levels: $2.60 $3.14 $3.50 $3.86 $4.40
Number of potential product profiles = 4X8X2X5 = 320	
Informational Treatments	Organic
	Environmental
	Organic + Environmental
	None

Table 1.1 Experimental Design

participants who did not. This will be a key addition to the literature in seeing how information affects consumer choice behavior in a choice experiment setting.

Along with the organic label, consumers may be presented with an "Environmentally Friendly" logo (Figure 1.2). The presence of this label on a product in the choice experiment indicates that the product produces less carbon output than the average product in this food category. This is an entirely hypothetical label as there are

Information regarding Organic product labeling:

The United States Department of Agriculture (USDA) has developed the National Organic Program (NOP) guidelines for organic food certification. Any packaged food product that can make a claim of being *Organic* must adhere to the rules set forth by the USDA regarding organic farming, distribution and processing.

Organic ingredients or products must be produced on a farm or in a facility that has been certified to be organic. There can be no use of synthetic fertilizers, no use of natural or synthetic pesticides or hormones. Genetically modified seed cannot be used. If a food product contains ingredients grown in a foreign country, the Secretary of Agriculture must approve the foreign farm or firm as an organic operation if the end product is to be deemed organic.

Below is a description of the various organic labels which can be used:

If a multi-ingredient processed food product contains at least 95% organic ingredients, then the producer can display the NOP seal.

100% Organic

If a multi-ingredient processed food product contains 100% organic ingredients, then the producer can display the NOP seal PLUS may use the words 100% Organic on the label.

Made with Organic Grains

If the product has less than 95% organic content, then the label cannot display the NOP seal above. However, if the product has more than 70% organic content, the manufacturer is allowed to list those ingredients that are organic on the front of the package. In this case, the cereal is made using organic grains.

If there is less than 70% organic content in the product, then organic claims cannot be made on the front product label. However, the firm may report organic content in the ingredients list.

Figure 1.1 Organic Informational Treatment

Figure 1.2 Environmentally Friendly Logo

currently no labels or standards sanctioned by the U.S. government for reporting carbon emissions for food products. As consumers make trade-offs between organic and environmental attributes, they will also make trade-offs between different benefits associated with each attribute. A product labeled as organic will provide both private and public benefits in that the consumer will get private benefits coming from a perceived health and nutritional standpoint, and will also contribute to public welfare in that organic farming does not use fertilizers or pesticides, thus reducing pollution. The environmentally friendly attribute will provide mostly public benefits in that a reduced carbon footprint is associated with less aggregate pollution and less contribution towards global climate change.

Because there is no standard labeling scheme for carbon output measures (as there is for organic labeling), consumers may be confused or mistrustful of this

"Environmentally Friendly" label. This essay addresses learning by adding informational treatments regarding carbon output to randomly selected respondents. In the same vein as our organic label, a proportion of participants will receive information that describes the "Environmentally Friendly" label in terms of the product's carbon output (Figure 1.3). Again, we will be interested to see if consumers that are presented with information will have different WTP estimates than consumers that receive no information.

Information regarding *Environmentally Friendly* food products:

The addition of carbon to the atmosphere has been linked to global warming. There is currently no universal measurement for the carbon output of a good or any carbon output measurement sanctioned by the US government. The products in this survey have been measured for their levels of carbon output. This measurement takes into account the carbon output from the growing of ingredients, the processing of ingredients into the final product, and the transportation of the final product to market. After measuring the carbon output levels for all products in this survey, the average carbon output level was calculated. If a product contains the "Environmentally Friendly" label, then the product produces less carbon output than the average product in this food category.

Figure 1.3 Environmental Informational Treatment

The COOL attribute provides insight into how a respondent may associate product quality with its country of origin. In this experiment, we communicate COOL in a novel two-part manner: 1) the country in which the ingredients were grown and 2) the country in which the ingredients were processed and packaged. We are unaware of any past research that differentiates between these two stages of production for COOL on a food product. This designation made between growing country and processing/packaging country may allow consumers to make their purchase decision with more information and better reflects the true nature of multi-ingredient products for sale.

Per the most recent rulings regarding COOL (Federal Register: 2008, 2013), there is no requirement for a processed food product to carry country of origin labeling, even if the processed food product contains ingredients that are identified as having a mandatory country of origin declaration (the current rules pertain largely to meats). Thus, we cannot determine the proportion of processed foods that contain ingredients from foreign countries, yet the value of food imports has risen from \$46.2 billion in 2002 to \$105.9 billion in 2012, and the corresponding volume has increased from 39.7 million tons to 56.2 million tons (ERS, 2013), indicating that the presence of imported foods are increasing in the American diet. To date, the USDA's Foreign Agricultural Service has no consistent data on organic trade or the level of foreign ingredients in processed foods, but preliminary estimates put the value of organic imports including fresh produce, processed foods and ingredients for manufactured products, at 12 to 18 percent of the \$8.6 billion in U.S. organic sales in 2002 (USDA, 2013).

Although the current method for tracking foreign ingredients in processed foods and for tracking organic food imports is lacking, the USDA has taken steps to make COOL mandatory in meat products at varying levels of production. Current regulations mandate that if certain meat products are to be labeled as a product of the U.S., then the animal must be born, raised and slaughtered in the U.S. If the animal has spent more than 60 days outside of the U.S., then that country must be listed as one of the countries of origin on the product. While this type of labeling is only required for certain meat products in the U.S., we extend this requirement to the multi-ingredient, processed breakfast cereal and in this paper. We explicitly present countries that have involvement at various stages of the production process. Although this level of information regarding COOL is not currently required of breakfast cereals in the U.S., this experiment will suggest how this type of labeling may influence consumer choice.

Three countries of origin are used to signal potential food quality and safety levels: the U.S., England and China. In addition to food quality and safety, consumers may make purchasing decisions to improve the economic prospects of the U.S., just as increasing trend in consumers buying locally produced food products may reflect consumer concern over local economic conditions (Batte et al. (2010), Darby et al. (2008)). We do not test directly for the origin of COOL preferences (quality, safety or national pride). However, if quality and safety is the dominant factor, then we posit that consumers will view U.S. and English products equally while Chinese products will be less preferred due to highly publicized incidents of Chinese food safety lapses occurring before the administration of the survey.[1] If national economic concern is the dominant factor, then purely U.S. products will be preferred to all others. A general hypothesis of this paper is that respondents will view goods that are grown and processed and packaged

[1] England's only well publicized food safety lapse involved beef and occurred more than a decade prior to data collection, suggesting little spillover to the cereal products involved in the experiment

in the U.S. to be safe, known goods for consumption; England will be viewed as an equivalent or at best, a premium signal in comparison with the U.S. at both stages of production; and Chinese goods will be viewed as an inferior, or at best, equivalent signal in comparison with the U.S. and England in both stages of production. Thus, purely U.S. goods will be preferred to purely English goods and purely English goods will be preferred to purely Chinese goods.

Janssen and Hamm (2012) find in their analysis of organic labeling in the EU that consumers place different WTP premiums on labels originating from different countries, even though the labels communicate identical information, and that consumer perceptions regarding the labels are of a subjective nature and not necessarily based on facts. We attempt to minimize this problem with the organic labeling information treatment. As previously described, the organic information treatment states that all internationally sourced ingredients and final goods with the NOP seal have passed certification by the USDA. It will be another point of interest to see if this organic information treatment has any impact on consumer behavior regarding COOL. Similarly, for products that are not purely grown and processed/packaged in the U.S., consumers may assume that these products cause a larger carbon footprint and may then be less likely to make a purchase. Per the environmental informational treatment, the presence of the environmentally friendly label means that the product was produced and brought to market while producing less than the average level of carbon for all other breakfast cereals. Therefore, the environmentally friendly label may have a positive effect on purchasing behavior for products that label either China or England as a grower or processor/packager, although this hypothesis cannot be tested with the current experimental design.

The design can reveal if consumers make trade-offs between the three countries in different stages of production, e.g., growing region versus processing/packaging region. At each stage of production, there are possibilities for food safety and quality to be compromised. At the growing stage, potentially harmful fertilizers and pesticides may be used to grow the grains, and filth and other impurities may be added by those handling the product during harvest. During processing and packaging, there is the potential for the inclusion of harmful additives or contamination due to unsanitary factory conditions. These problems have been mostly associated with Chinese exports in recent history, with examples including counterfeit baby formula in 2004 (BBC News, 2004), tainted dumplings in 2008 (Japan Times, 2008), and, perhaps of greatest pertinence to this experiment, contaminated gluten and rice protein for export in 2007 (Associated Press, 2007). The contaminated gluten and proteins contained the poisonous substance melamine and resulted in the death of pets in the U.S., and furthered international mistrust of Chinese food exports. Frozen strawberries contaminated with norovirus exported from China were to blame for 11,000 cases of stomach flu in Germany (Der Spiegel, 2012). In addition to looking at trade-offs within the COOL label, we will also be interested to see if consumers trade-off between COOL, eco-labeling and organic labeling.

As noted earlier, participants receive one of four possible information treatments: (1) information detailing the NOP label, (2) information detailing the "Environmentally

Friendly" label, (3) both organic and environmental information (1 and 2), or (4) no information treatment. It is of interest to see if there is any information spillover between information groups, meaning that: a participant may receive an information treatment regarding organic products, but this information may trigger thoughts that make them more environmentally conscious, and thus may influence their valuation of goods with environmental attributes. Effects will be measured by comparing between information treatment groups.

There are a total of 320 product profiles that can possibly be produced from our attribute levels, independent of the informational prompts. A respondent is exposed to 5 choice situations where each choice set consists of 3 product profiles plus an option to choose "none presented." For choice situations, we remove any choice situation in which product profile combinations only differ on one attribute e.g., if any two products in any choice situation are identical except for price, then that combination of product profiles will be rejected and another random choice situation is generated within the choice set. A total of 750 orthogonal choice sets, composed of 5 choice situations each with 3 products per choice situation, were generated such that every product attribute has near equal representation. Table 1.2 presents the frequency of every product attribute across all usable data for estimation. Note that the sums within each attribute set sum to 75% because the 'none' option represents 25% of the data. These choice sets were randomly assigned to participants within each of the 4 treatment groups.

Attribute	Frequency
Organic Content	
"100% Organic" + NOP	19%
NOP	20%
"Made With Organic Grains"	19%
Blank	17%
Total Organic Content	75%
Environment	
"Environmentally Friendly"	38%
Blank	37%
Total Environment	75%
COOL	
Processed/Packaged US Grown US	10%
Processed/Packaged US Grown UK	10%
Processed/Packaged US Grown CH	9%
Processed/Packaged UK Grown UK	9%
Processed/Packaged CH Grown UK	10%
Processed/Packaged UK Grown CH	9%
Processed/Packaged CH Grown CH	10%
Blank	8%
Total COOL	75%
Price	
$2.60	15%
$3.14	15%
$3.50	15%
$3.86	15%
$4.40	15%
Total Price	75%
Note: UK represents England	

Table 1.2 Frequencies of Product Attributes

We test three main hypotheses concerning product attributes and informational treatments:

Hypothesis 1: Consumers who receive informational treatments will have higher WTP estimates for the corresponding product attribute than consumers who receive no information.

Hypothesis 2: Consumers who receive the combined organic and environmental information will have higher WTP for organic and environmental attributes than all other informational groups.

Hypothesis 3a: Amongst the COOL attributes, products featuring Chinese involvement in either processing/packaging or growing region of ingredients will have a lower WTP estimate than all other products.

Hypothesis 3b: Amongst the COOL attributes, purely U.S. goods will have the highest WTP over all other products.

Section 1.4 Data Description

The stated choice data used in this paper comes from choice experiments conducted as part of a larger attitudinal and behavioral survey. The survey was administered by Survey Sampling International (SSI) during June 2011. SSI maintains a sample of potential participants that is representative of the U.S., and the survey was administered to this sample. Participants were rewarded for their participation in the survey by gaining "points" that can be traded in for goods through SSI. Only fully completed surveys were collected for analysis, resulting in 3,000 respondents in the data set. Each participant in the survey completed 5 randomly generated choice experiments or situations after receiving their informational treatment, resulting in 5 X 3,000 = 15,000 possible choices used in estimation (see Appendix A for a sample choice experiment).

Of the 3,000 participants in the survey, not all were included in the sample used for estimation. A total 11% choose the option "None: I would not choose any of these" for all 5 choice experiments. These participants are classified as non-responders and are dropped from the estimation sample used for choice modeling. It may be that these consumers do not eat breakfast cereal and truly would not choose any option present, or that the respondent did not fully participate in the choice experiment. Another excluded group includes those who appeared to rush through the choice experiment. The average time spent on the survey is 9 minutes and 20 seconds with a standard deviation of 3 minutes and 48 seconds. Any participant who took less than a reasonable amount of time, about 5 minutes, to complete the survey is dropped from the analysis, resulting in a loss of about 4% of data. Finally, respondents deemed inattentive were also dropped. In the survey, consistency questions were asked to make sure that participants were paying attention to the question being asked of them. If a participant “Strongly Agreed” with both statements “The foods available at my local grocery are safe” and “I am concerned that the foods available in my local grocery are not safe”, then the participant is labeled as inconsistent and is dropped from the estimation sample, about 3% of data. After all data cleaning, a representative 2,382 respondents remain for empirical estimation, which is 79.4% of the original sample.

Referring to Table 1.3, we can see some of the demographic characteristics of the sample in comparison with statistics collected from the 2010 Census (2010 Census). We organize our sample by treatment groups due to their importance to this research. Treatment group 1 has 597 respondents, treatment group 2 has 600, treatment group 3 has 622, treatment group 4 has 563, and the respective percentages of the total 2,382 respondents are 25%, 25%, 26% and 24%. All race categories except White, not Hispanic / Latino category are underrepresented while the White, not Hispanic / Latino category is overrepresented. The sample income data appears to be fairly representative of the nation with only the highest income earners being underrepresented. Finally, the sample is biased towards those who have attained a Bachelor’s degree.

Socioeconomic Variable	National	Total Sample	Treatment Group 1	Treatment Group 2	Treatment Group 3	Treatment Group 4
Race						
Black or African American	12.6	8.4	8.0	9.0	10.3	7.5
American Indian or Alaska native	0.9	0.7	0.8	0.5	0.3	0.5
Asian or Asian American	4.8	1.4	1.3	1.2	1.9	1.6
Native Hawaiian or Other Pacific Islander	0.2	0.0	0.0	0.0	0.2	0.2
Hispanic/Latino	16.3	5.3	5.7	5.5	3.9	5.0
White, not Hispanic/Latino	62.3	82.3	82.2	81.3	82.2	83.8
Mixed Race	2.9	1.8	1.8	2.5	1.3	1.4
Household Income						
Less than $10,000	7.6	5.8	5.5	6.3	6.6	5.3
$10,000-$14,999	5.8	4.9	4.2	5.3	6.1	5.9
$15,000-$24,999	11.5	13.3	12.9	14.2	15.1	12.3
$25,000-$34,999	10.8	12.7	12.2	13.5	12.5	13.9
$35,000-$49,999	14.2	13.3	12.2	15.8	13.3	14.9
$50,000-$74,999	18.3	23.8	24.5	21.2	23.3	24.0
$75,000-$99,999	11.8	12.8	13.4	11.7	11.6	13.0
$100,000-$149,999	11.8	10.0	11.1	8.2	9.0	8.3
$150,000-$200,000	4.2	2.0	2.2	2.3	1.8	1.1
$200,000 and over	3.9	1.6	1.8	1.5	0.6	1.4
Education						
Less than 9th grade	6.1	0.3	0.3	0.2	0.2	0.7
9th to 12th grade no diploma	8.3	2.2	2.3	2.8	1.8	1.4
High school graduate (or equivalency)	28.5	18.6	17.3	20.3	20.4	20.4
Some college, no degree	21.3	30.4	29.1	32.0	33.1	30.7
Associates degree	7.6	9.9	8.9	11.8	11.9	9.8
Bachelor's degree	17.7	25.9	28.1	22.0	23.3	23.6
Graduate or Professional Degree	10.4	12.7	13.9	10.8	9.3	13.3
Number in Sample	-	2382	597	600	622	563

Continued

Table 1.3 Respondent Characteristics

Table 1.3 Continued

Socioeconomic Variable	National	Total Sample	Treatment Group 1	Treatment Group 2	Treatment Group 3	Treatment Group 4
Marital Status						
Never Married	32.2	19.9	18.8	23.2	21.7	19.4
Married	48.8	52.4	53.6	49.8	50.2	52.4
Living Together	-	8.0	7.7	8.0	8.0	9.1
Widowed	6.0	4.5	4.5	5.0	4.5	4.3
Divorced / Separated	13.0	15.2	15.4	14.0	15.6	14.9
Number in Sample	-	2382	597	600	622	563

Pearson Chi-square test of equal proportions between National and total sample is rejected for all categories:

Race: χ^2 = 276.0 p-value < 0.001 Household Income: χ^2 = 88.1 p-value < 0.001

Marital Status: χ^2 = 13.3 p-value = 0.004 Education: χ^2 = 333.8 p-value < 0.001

Pearson Chi-square test of equal proportions across treatment groups fail to reject equality for all categories:

Race: χ^2 = 13.8 p-value = 0.741 Household Income: χ^2 = 22.6 p-value = 0.707

Marital Status: χ^2 = 6.5 p-value = 0.890 Education: χ^2 = 26.9 p-value = 0.082

Section 1.5 Methodology

Two econometric approaches are used to analyze the data: a multinomial logit (MNL) model and a random parameters logit (RPL), which is also known in the literature as a mixed-logit model. The MNL imposes the assumption that preferences are homogeneous across respondents, while the RPL allows for preference heterogeneity in the data. For explanation of the MNL and RPL models, we use notation and methodology set forth by Greene and Hensher (2007) and Colombo, Hanley and Louviere, (2009).

The random utility framework (Mc Fadden, 1973) states that a consumer's utility function can be expressed as

$$U_{qjt} = V_{qjt} + \varepsilon_{qjt} \tag{1}$$

where U_{qjt} is the unobserved utility of individual q choosing alternative j in choice situation t, V_{qjt} as the observable or systematic component of utility and ε_{qjt} as the unobservable or random component of utility. We assume that individuals $q = 1,\ldots,\boldsymbol{Q}$ will make their choice of alternative $j = 1,\ldots,\boldsymbol{J}$ in choice situation $t = 1,\ldots,\boldsymbol{T}$ such that their individual utility will be maximized. The full factorial set of attribute combinations cannot be evaluated by each participant. Therefore, we allow choice sets $\boldsymbol{J}$ to vary across individual q and choice situation t. We compile all of the product attributes into the $\boldsymbol{K}$ x 1 vector $\boldsymbol{X}_{qjt}$. This results in the latent utility function

$$U_{qjt} = \boldsymbol{\beta}'\boldsymbol{X}_{qjt} + \varepsilon_{qjt} \tag{2}$$

where $\boldsymbol{\beta}'$ is a vector of parameters associated with the explanatory vector$\boldsymbol{X}_{qjt}$. If we are to assume that error variances follow an identically independent (IID) type 1 extreme value distribution (EV1), then we have the multinomial logit (MNL) model

$$\text{Prob}\{\text{choose } j|\text{individual } q, \boldsymbol{X}_{qjt}, \text{choice situation } t\} = \frac{\exp(\boldsymbol{\beta}'\boldsymbol{X}_{qjt})}{\sum_{j=1}^{J}\exp(\boldsymbol{\beta}'\boldsymbol{X}_{qjt})}. \tag{3}$$

While the MNL model has been the workhorse model for many years in the realm of choice modeling, the model assumes preference homogeneity. Although various characteristics that express heterogeneity amongst individuals can be interacted with the attributes of interest, they are a crude way of representing preference heterogeneity (Colombo, Hanley and Louviere, 2009). Furthermore, the MNL model assumes independence of irrelevant alternative (IIA), and that the model does not capture preference heterogeneity that is not explicitly present in individual characteristics or the IID-EV1 error (Greene and Hershner, 2007).

The RPL extends the MNL model by allowing random parameters to be estimated for all q individuals, resulting in the RPL model

$$U_{qjt} = \boldsymbol{\beta}'\boldsymbol{X}_{qjt} + \boldsymbol{\eta}'_{\boldsymbol{q}}\boldsymbol{X}_{qjt} + \varepsilon_{qjt}, \tag{4}$$

for $\boldsymbol{\beta}$ as the parameter vector associated with our product attributes, socioeconomic characteristics and survey responses, and $\boldsymbol{\eta_q}$ contains k = 1,…$\boldsymbol{K}$ individual-specific standard deviation parameters. Our random variable ε_{qjt} is assumed IID and Gumbel distributed. This generates an individual $\boldsymbol{\beta_q}$ that deviates from the population mean vector $\boldsymbol{\beta}$ by the vector $\boldsymbol{\eta_q}$. Denoting the observed sequence of choices of any individual as y_q, we calculate the probability of said sequence by solving the integral

$$P_q[y_1, \dots, y_T] \ = \ \int \dots \int \prod_{t=1}^{T} \left[\frac{\exp(\boldsymbol{\beta_q X}_{qjt})}{\sum_{q=1}^{Q} \exp(\boldsymbol{\beta_q X}_{qjt})}\right] f(\beta) d\beta. \quad (5)$$

This integral has no closed form solution and is simulated by using Halton draws.

The estimated model will be used to estimate consumer willingness to pay for each product attribute. The definition for WTP for attribute k is the negative ratio of the estimated parameter for attribute k (β_k) and price parameter $\left(\beta_p\right)$

$$WTP_k = -\left({}^{\beta_k}\!/_{\beta_p}\right). \quad (6)$$

The WTP estimate is asymptotically normally distributed for the MNL model in the simplified form

$$WTP_k \xrightarrow{D} N\left(WTP_k, \frac{1}{\beta_p^2}\left(Var(\beta_k) - 2WTP_k Cov\left(\beta_k, \beta_p\right) + WTP_k^2 Var\left(\beta_p\right)\right)\right). \quad (7)$$

The above result yields a standard error which is used to calculate a 95% confidence interval for each WTP measure in the MNL model and results are reported in the next section. Because the MNL model assumes preference homogeneity across all respondents, there is little uncertainty as to the mean and standard error of the WTP measure.

In the case of the RPL model, both the estimated attribute means and standard deviations are functions of estimated parameters, and thus there is a degree of uncertainty regarding the distribution of each WTP estimate. Therefore, a variant of the Delta Method is employed to calculate the asymptotic distribution of WTP for each product attribute.

Bliemer and Rose (2013) propose extending the Delta Method to include using the estimated mean and standard deviation of both price (β_p) and attribute (β_k) parameters to simulate the mean and variance of WTP estimates for the RPL model. This method can be used for any combination of distributional assumptions placed upon the price and product attribute parameters.

Followng Bliemer and Rose (2013), any random parameter in the RPL model can be expressed as:

$$\beta = \beta(z|\theta), \tag{8}$$

where the random parameter β follows a probability distribution with a vector of parameters θ and standard probability distribution z. Because all of the random parameters in this paper are assumed to follow a normal distribution, we can re-write the expression (8) as $\beta = \mu + \sigma z$ where z follows a standard normal distribution, $N(0,1)$. With all random parameters expressed as a function of their respective mean, standard deviation and normal distribution, the WTP for any product attribute k is expressed as:

$$WTP_k = -\frac{\beta_k}{\beta_p} = -\frac{\mu_k + \sigma_k z_k}{\mu_p + \sigma_p z_p} \tag{9}$$

where μ represents the estimated mean and σ the estimated standard deviation for product attributes and price. Therefore, the WTP for an attribute is a function of attribute parameters θ_k (μ_k and σ_k), price parameters θ_p (μ_p and σ_p), and normally distributed random variables z_k and z_p. Applying the Delta method to the above expression of WTP, we arrive at:

$$WTP_k(z_k, z_p) \xrightarrow{D} N\left(WTP_k, \begin{pmatrix} \nabla_{\theta_k} WTP_k \\ \nabla_{\theta_p} WTP_k \\ \nabla_{z_k} WTP_k \\ \nabla_{z_p} WTP_k \end{pmatrix}^T \begin{pmatrix} \Omega_{\theta_{kp}} & \mathbf{0} \\ \mathbf{0} & diag(1, \dots 1) \end{pmatrix} \begin{pmatrix} \nabla_{\theta_k} WTP_k \\ \nabla_{\theta_p} WTP_k \\ \nabla_{z_k} WTP_k \\ \nabla_{z_p} WTP_k \end{pmatrix} \right) \quad (10)$$

where $\nabla_{\theta_k} WTP_k$ and $\nabla_{\theta_p} WTP_k$ are the Jacobians of WTP with respect to θ_k and θ_p, $\nabla_{z_k} WTP_k$ and $\nabla_{z_p} WTP_k$ are the Jacobians of WTP with respect to z_k and z_p and $\Omega_{\theta_{kp}}$ is the variance covariance matrix of the distributional parameters θ_k and θ_p. The distribution in (10) becomes:

$$WTP_k(z_k, z_p) \xrightarrow{D} N$$

$$\left(WTP_k(z_k, z_p), \frac{1}{\beta_p^2(z_p)} \begin{pmatrix} 1 \\ z_k \\ -WTP_k(z_k, z_p) \\ -WTP_k(z_k, z_p) z_p \\ \sigma_k \\ -WTP_k(z_k, z_p)\sigma_p \end{pmatrix}^T \begin{pmatrix} \Omega_{(\mu_k, \sigma_k, \mu_p, \sigma_p)} & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} 1 \\ z_k \\ -WTP_k(z_k, z_p) \\ -WTP_k(z_k, z_p) z_p \\ \sigma_k \\ -WTP_k(z_k, z_p)\sigma_p \end{pmatrix} \right) \quad (11)$$

when the Jacobians are calculated for the normal distributional assumption on price and product attributes. For any random draw of z_p and z_k the unconditional expected WTP estimate WTP_k^* is defined as:

$$WTP_k^* = \iint_{z_k z_p} WTP_k(z_k, z_p) dF_k(z_k) dF_p(z_p). \quad (12)$$

The unconditional mean estimate of WTP is approximated by Monte Carlo simulation where:

$$WTP_k^* \approx \frac{1}{R}\sum_{r=1}^{R} WTP_k(z_k^r, z_p^r) \tag{13}$$

for $r = 1, \dots, R$ and (z_k^r, z_p^r) are random draws from the assumed normal distributions $F_k(z_k)$ and $F_p(z_p)$. Because $WTP_k^*(z_k^r, z_p^r)$ is asymptotically normally distributed, then in the limit WTP_k^* is also normally distributed with the simulated variance:

$$var(WTP_k^*) \approx$$

$$\frac{1}{R}\sum_{r=1}^{R}\left(\frac{1}{\left(\beta_p^r(z_p{}^r)\right)^2}\begin{pmatrix}1\\ z_k{}^r\\ -WTP_k{}^r(z_k{}^r, z_p{}^r)\\ -WTP_k{}^r(z_k{}^r, z_p{}^r)z_p{}^r\\ \sigma_k\\ -WTP_k{}^r(z_k{}^r, z_p{}^r)\sigma_p\end{pmatrix}^T \begin{pmatrix}\Omega_{(\mu_k,\sigma_k,\mu_p,\sigma_p} & 0 & 0\\ 0 & 1 & 0\\ 0 & 0 & 1\end{pmatrix}\begin{pmatrix}1\\ z_k{}^r\\ -WTP_k{}^r(z_k{}^r, z_p{}^r)\\ -WTP_k{}^r(z_k{}^r, z_p{}^r)z_p{}^r\\ \sigma_k\\ -WTP_k{}^r(z_k{}^r, z_p{}^r)\sigma_p\end{pmatrix}\right) \tag{14}$$

with $WTP_k{}^r\left(z_k{}^r, z_p{}^r\right) = -\frac{\mu_k+\sigma_k z_k{}^r}{\mu_p+\sigma_p z_p{}^r}$.

Bliemer and Rose (2013) note that when price is assumed to have a normal distribution that is defined within the domain of $(-\infty, +\infty)$, the integrals will not be defined when $\beta_p = 0$ and the simulated values of WTP may be quite large for values of the price coefficient that are near to zero. Thus, the median and not the average of the R Monte Carlo simulations are used as the approximation to the integral of WTP. In the RPL model, the WTP mean and variance calculation is the same for fixed parameters as it is for normally distributed parameters, noting that for fixed parameters z_k does not exist and Jacobians are changed to reflect the lack of uncertainty of β_k. In this work 25,000 simulations are run for each product attribute and the mean and variance of WTP is calculated. The resulting mean and variance of WTP from both random and fixed parameters are then used to calculate the 95% confidence interval by adding and subtracting the square root of the variance multiplied by 1.96 from the mean WTP measure.

Section 1.6 Results

1.6.1 Multinomial Logit

The base model is estimated using a Multinomial Logit (MNL) specification. Each of the 2,382 usable respondents completed 5 choice experiments resulting in 11,910 choice observations for analysis, where each choice observation consists of 4 possible choices (products 1, 2, 3 or none). Under the MNL assumptions all respondents in the sample have identical utility functions, thus we can view the results as if one person made all 11,910 choices in the data set. All results are interpreted in reference to a product that has no organic, environmental or country-of-origin labeling.

Looking to Table 1.4 we see the coefficients representing the effects on the probability of making a choice for all parameters in the equation, the associated standard errors and significance levels. The variables list is composed of all attribute levels regarding organic content, environmentally friendliness and COOL, and has been interacted with all informational treatment levels. What we have is a model of product choice explained by price and an exhaustive list of all product attribute levels and information treatment combinations. The model has a log-likelihood of -13,053.15 and all explanatory variables but 5 out of 45 are significantly different from zero at the 10% level and most variables have a *p*-value less than 0.01. The COOL attribute processed/packaged in the US with grains grown in China is not statistically different from zero for all informational treatments.

Table 1.5 organizes the results from Table 1.4 in a fashion that lends to simpler comparisons across information treatments for each attribute (top panel) and across

Number of Observations = 47,640	R-squared = .208			
Log-Likelihood = -13053.15				
Variable	Coeff.	S.E.	z-stat	p-value
PRICE	-0.655	0.017	-38.013	0.000
[“100% Organic” + NOP]*Organic Info	1.872	0.072	26.157	0.000
[“100% Organic” + NOP]*Enviro Info	1.411	0.071	19.868	0.000
[“100% Organic” + NOP]*Organic + Enviro Info	1.676	0.070	23.932	0.000
[“100% Organic” + NOP]*No Info	1.504	0.075	19.933	0.000
[NOP]*Organic Info	1.660	0.072	23.070	0.000
[NOP]*Enviro Info	1.353	0.071	19.074	0.000
[NOP]*Organic + Enviro Info	1.387	0.071	19.415	0.000
[NOP]*No Info	1.334	0.075	17.693	0.000
[“Made With Organic Grains”]*Organic Info	1.141	0.075	15.206	0.000
[“Made With Organic Grains”]*Enviro Info	1.065	0.073	14.576	0.000
[“Made With Organic Grains”]*Organic + Enviro Info	1.147	0.073	15.782	0.000
[“Made With Organic Grains”]*No Info	0.911	0.079	11.478	0.000
[Environmenatlly Friendly Label]*Organic Info	0.956	0.049	19.604	0.000
[Environmenatlly Friendly Label]*Enviro Info	1.140	0.050	22.811	0.000
[Environmenatlly Friendly Label]*Organic + Enviro Info	1.091	0.049	22.292	0.000
[Environmenatlly Friendly Label]*No Info	1.008	0.053	19.067	0.000
[Processed/Packaged US Grown US]*Organic Info	2.017	0.081	24.835	0.000
[Processed/Packaged US Grown US]*Enviro Info	2.247	0.082	27.451	0.000
[Processed/Packaged US Grown US]*Organic + Enviro Info	2.204	0.081	27.353	0.000
[Processed/Packaged US Grown US]*No Info	2.544	0.087	29.306	0.000
[Processed/Packaged US Grown UK]*Organic Info	0.770	0.086	8.947	0.000
[Processed/Packaged US Grown UK]*Enviro Info	0.975	0.084	11.642	0.000
[Processed/Packaged US Grown UK]*Organic + Enviro Info	0.918	0.083	11.119	0.000
[Processed/Packaged US Grown UK]*No Info	0.941	0.088	10.692	0.000
[Processed/Packaged US Grown CH]*Organic Info	0.055	0.097	0.567	0.571
[Processed/Packaged US Grown CH]*Enviro Info	0.021	0.100	0.214	0.830
[Processed/Packaged US Grown CH]*Organic + Enviro Info	-0.005	0.098	-0.048	0.962
[Processed/Packaged US Grown CH]*No Info	0.008	0.104	0.076	0.939
[Processed/Packaged UK Grown UK]*Organic Info	0.510	0.089	5.722	0.000
[Processed/Packaged UK Grown UK]*Enviro Info	0.440	0.091	4.856	0.000
[Processed/Packaged UK Grown UK]*Organic + Enviro Info	0.487	0.088	5.500	0.000
[Processed/Packaged UK Grown UK]*No Info	0.411	0.094	4.358	0.000
[Processed/Packaged CH Grown UK]*Organic Info	-0.396	0.108	-3.682	0.000
[Processed/Packaged CH Grown UK]*Enviro Info	-0.457	0.111	-4.114	0.000
[Processed/Packaged CH Grown UK]*Organic + Enviro Info	-0.564	0.110	-5.121	0.000
[Processed/Packaged CH Grown UK]*No Info	-0.843	0.129	-6.522	0.000
Note: UK represents England				

Continued
Table 1.4 MNL Results

Table 1.4 Continued

Variable	Coeff.	S.E.	z-stat	p-value
[Processed/Packaged UK Grown CH]*Organic Info	-0.158	0.102	-1.542	0.123
[Processed/Packaged UK Grown CH]*Enviro Info	-0.197	0.104	-1.888	0.059
[Processed/Packaged UK Grown CH]*Organic + Enviro Info	-0.277	0.103	-2.674	0.008
[Processed/Packaged UK Grown CH]*No Info	-0.484	0.118	-4.114	0.000
[Processed/Packaged CH Grown CH]*Organic Info	-0.572	0.113	-5.061	0.000
[Processed/Packaged CH Grown CH]*Enviro Info	-0.617	0.117	-5.265	0.000
[Processed/Packaged CH Grown CH]*Organic + Enviro Info	-0.778	0.119	-6.527	0.000
[Processed/Packaged CH Grown CH]*No Info	-0.701	0.126	-5.578	0.000

Note: UK represents England

attributes for each information treatment (middle panel). We separate the analysis into three segments: 1) organic, 2) environment and 3) COOL, and look both across attribute levels by treatment group and within attribute levels by treatment group within each of the aforementioned segments.

Looking to the organic segment in Table 1.5 we see the ordering of parameter estimates by each of the attribute levels. The "100% Organic" + NOP attribute has the largest coefficient, signifying the greatest probability to purchase by informational treatment. Organic Info is ranked the highest followed by Organic + Environmental Info, then by No Info and lastly by Environmental Info. Similarly we see that Organic Info has the highest estimate for the NOP attribute followed closely by a near three-way-tie between all other informational treatments. Lastly the "Made With Organic Grains" attribute level reveals a tight pairing of both Organic Info and Organic + Environmental Info as the greatest probability to purchase while Environmental Info and No Info have smaller effects. While the results are not consistent across the attribute levels, it is clear

Variable	Coefficient
[“100% Organic” + NOP]*Organic Info	1.872
[“100% Organic” + NOP]*Organic + Enviro Info	1.676
[“100% Organic” + NOP]*No Info	1.504
[“100% Organic” + NOP]*Enviro Info	1.411
[NOP]*Organic Info	1.660
[NOP]*Organic + Enviro Info	1.387
[NOP]*Enviro Info	1.353
[NOP]*No Info	1.334
[“Made With Organic Grains”]*Organic + Enviro Info	1.147
[“Made With Organic Grains”]*Organic Info	1.141
[“Made With Organic Grains”]*Enviro Info	1.065
[“Made With Organic Grains”]*No Info	0.911
[“100% Organic” + NOP]*Organic Info	1.872
[NOP]*Organic Info	1.660
[“Made With Organic Grains”]*Organic Info	1.141
[“100% Organic” + NOP]*Enviro Info	1.411
[NOP]*Enviro Info	1.353
[“Made With Organic Grains”]*Enviro Info	1.065
[“100% Organic” + NOP]*Organic + Enviro Info	1.676
[NOP]*Organic + Enviro Info	1.387
[“Made With Organic Grains”]*Organic + Enviro Info	1.147
[“100% Organic” + NOP]*No Info	1.504
[NOP]*No Info	1.334
[“Made With Organic Grains”]*No Info	0.911
[Environmentally Friendly Label]*Enviro Info	1.140
[Environmentally Friendly Label]*Organic + Enviro Info	1.091
[Environmentally Friendly Label]*No Info	1.008
[Environmentally Friendly Label]*Organic Info	0.956

Table 1.5 MNL Results by Organic and Environmental Segments

that within the organic segment, the organic informational treatment (whether on its own or in conjunction with environmental information) garners the highest probability of purchase.

We can also see in middle panel of Table 1.5 that when we hold the informational treatment fixed, there is a consistent ordering of effects by organic content. For all informational treatments, “100% Organic” + NOP ranks the highest, followed by NOP and lastly “Made With Organic Grains”, indicating that higher organic content is associated with higher effects.

Table 1.5 also reports the same analysis for the environmentally friendly segment as for the organic content segment (bottom panel). The environmental information treatment has the largest effect on purchase probability while the combined organic and environmental information treatment, no informational treatment and organic informational treatment have the lower effects.

The COOL segment has a similar analysis in Tables 1.6 and 1.7 as the organic and environmental segment analysis in Table 1.5, but the findings are not clear as to how informational treatments affect consumer behavior. Each combination of processing/packaging and growing country is presented along with the ordering of parameter estimates by informational treatment in Table 1.6. The organic informational treatment is associated with the highest purchase effect for a purely English product, and it is also associated with the lowest purchase effect for a purely U.S. product, and thus provides little insight.

Continuing on in Table 1.7, we see the ordering of the COOL attribute within each informational treatment group. Here we see some consistency in that across all treatment groups, a purely U.S. product garners the highest premium, followed by a product processed/packaged in the U.S. with grains grown in England, then by a purely English product and then by a product that is processed/packaged in the U.S. with grains grown in China. The ordering of the last three product attributes of COOL are mixed across informational treatments, but it is clear that a product with Chinese involvement at any stage in the process of final product development has a negative effect on purchase probability for the product.

Using the results from Table 1.4, an exhaustive set of pair-wise equality tests are performed for each attribute level across all informational treatments. The goal is to see whether or not parameter estimates are equal across the informational treatments for each

Variable	Coefficient
[Processed/Packaged US Grown US]*No Info	2.544
[Processed/Packaged US Grown US]*Enviro Info	2.247
[Processed/Packaged US Grown US]*Organic + Enviro Info	2.204
[Processed/Packaged US Grown US]*Organic Info	2.017
[Processed/Packaged US Grown UK]*Enviro Info	0.975
[Processed/Packaged US Grown UK]*No Info	0.941
[Processed/Packaged US Grown UK]*Organic + Enviro Info	0.918
[Processed/Packaged US Grown UK]*Organic Info	0.770
[Processed/Packaged US Grown CH]*Organic Info	0.055
[Processed/Packaged US Grown CH]*Enviro Info	0.021
[Processed/Packaged US Grown CH]*No Info	0.008
[Processed/Packaged US Grown CH]*Organic + Enviro Info	-0.005
[Processed/Packaged UK Grown UK]*Organic Info	0.510
[Processed/Packaged UK Grown UK]*Organic + Enviro Info	0.487
[Processed/Packaged UK Grown UK]*Enviro Info	0.440
[Processed/Packaged UK Grown UK]*No Info	0.411
[Processed/Packaged CH Grown UK]*Organic Info	-0.396
[Processed/Packaged CH Grown UK]*Enviro Info	-0.457
[Processed/Packaged CH Grown UK]*Organic + Enviro Info	-0.564
[Processed/Packaged CH Grown UK]*No Info	-0.843
[Processed/Packaged UK Grown CH]*Organic Info	-0.158
[Processed/Packaged UK Grown CH]*Enviro Info	-0.197
[Processed/Packaged UK Grown CH]*Organic + Enviro Info	-0.277
[Processed/Packaged UK Grown CH]*No Info	-0.484
[Processed/Packaged CH Grown CH]*Organic Info	-0.572
[Processed/Packaged CH Grown CH]*Enviro Info	-0.617
[Processed/Packaged CH Grown CH]*No Info	-0.701
[Processed/Packaged CH Grown CH]*Organic + Enviro Info	-0.778
Note: UK represents England	

Table 1.6 MNL Results by COOL Segment

attribute level, e.g., to see if the estimate for the NOP label given organic information is statistically different from the estimate for the NOP label given no information. Tables 1.8 and 1.9 reports a list of all pair-wise equality tests, associated *p*-values, and whether or not we can reject the null hypothesis that the parameter estimates are equal at the 10% level. All tests in Tables 1.8 and 1.9 that are related to the central hypothesis

Variable	Coefficient
[Processed/Packaged US Grown US]*Organic Info	2.017
[Processed/Packaged US Grown UK]*Organic Info	0.770
[Processed/Packaged UK Grown UK]*Organic Info	0.510
[Processed/Packaged US Grown CH]*Organic Info	0.055
[Processed/Packaged UK Grown CH]*Organic Info	-0.158
[Processed/Packaged CH Grown UK]*Organic Info	-0.396
[Processed/Packaged CH Grown CH]*Organic Info	-0.572
[Processed/Packaged US Grown US]*Enviro Info	2.247
[Processed/Packaged US Grown UK]*Enviro Info	0.975
[Processed/Packaged UK Grown UK]*Enviro Info	0.440
[Processed/Packaged US Grown CH]*Enviro Info	0.021
[Processed/Packaged UK Grown CH]*Enviro Info	-0.197
[Processed/Packaged CH Grown UK]*Enviro Info	-0.457
[Processed/Packaged CH Grown CH]*Enviro Info	-0.617
[Processed/Packaged US Grown US]*Organic + Enviro Info	2.204
[Processed/Packaged US Grown UK]*Organic + Enviro Info	0.918
[Processed/Packaged UK Grown UK]*Organic + Enviro Info	0.487
[Processed/Packaged US Grown CH]*Organic + Enviro Info	-0.005
[Processed/Packaged UK Grown CH]*Organic + Enviro Info	-0.277
[Processed/Packaged CH Grown UK]*Organic + Enviro Info	-0.564
[Processed/Packaged CH Grown CH]*Organic + Enviro Info	-0.778
[Processed/Packaged US Grown US]*No Info	2.544
[Processed/Packaged US Grown UK]*No Info	0.941
[Processed/Packaged UK Grown UK]*No Info	0.411
[Processed/Packaged US Grown CH]*No Info	0.008
[Processed/Packaged UK Grown CH]*No Info	-0.484
[Processed/Packaged CH Grown CH]*No Info	-0.701
[Processed/Packaged CH Grown UK]*No Info	-0.843
Note: UK represents England	

Table 1.7 MNL Results by COOL Segment

of this paper are in bold. Given that each attribute level has 4 informational treatments, a total of 6 equality tests are calculated for each attribute. Across the organic content segment, we can reject equality for 5 of 6 tests for “100% Organic” + NOP, 3 out of 6 for NOP and 2 out of 6 for “Made With Organic Grains.” This suggests that as the level of organic content increases, we can reject more equality tests, implying that information alters the expressed preference for the organic product. We reject 3 out of 6 equality tests for “Environmentally Friendly” labels and lastly reject 9 out of 42 equality tests across all of the COOL attributes. Given the results across the COOL segment, there appears to be little impact of informational treatments for processor/packager and grower regions outside a product that is both grown and packaged in the U.S. or products that involve a combination of England and China.

For organic attribute levels “100% Organic” + NOP and “Made With Organic Grains” we can reject the hypotheses that parameter estimates on organic information is equal to no information and that the combined organic + environmental information is equal to no information. From this result, plus results stated earlier, we can say that informational treatments containing organic information have a positive effect on purchase probability. The NOP and Environmentally Friendly attributes have mixed results: when the relevant informational treatment is presented on its own, estimates are significantly different from the no information treatment, yet when the informational treatments are combined (organic and environmental) the estimates are not significantly

100% Organic + NOP		p-value	Reject @ 10%
Organic Info	Environmental Info	0.000	YES
Organic Info	Organic + Environmental Info	0.038	YES
Organic Info	**No Info**	**0.000**	**YES**
Environmental Info	Organic + Environmental Info	0.006	YES
Environmental Info	No Info	0.343	NO
Organic + Environmental Info	**No Info**	**0.076**	**YES**
NOP			
Organic Info	Environmental Info	0.002	YES
Organic Info	Organic + Environmental Info	0.005	YES
Organic Info	**No Info**	**0.001**	**YES**
Environmental Info	Organic + Environmental Info	0.723	NO
Environmental Info	No Info	0.845	NO
Organic + Environmental Info	**No Info**	**0.592**	**NO**
Made With Organic Grains			
Organic Info	Environmental Info	0.445	NO
Organic Info	Organic + Environmental Info	0.952	NO
Organic Info	**No Info**	**0.030**	**YES**
Environmental Info	Organic + Environmental Info	0.403	NO
Environmental Info	No Info	0.136	NO
Organic + Environmental Info	**No Info**	**0.024**	**YES**
Environmentally Friendly			
Organic Info	Environmental Info	0.006	YES
Organic Info	Organic + Environmental Info	0.037	YES
Organic Info	No Info	0.437	NO
Environmental Info	Organic + Environmental Info	0.451	NO
Environmental Info	**No Info**	**0.054**	**YES**
Organic + Environmental Info	**No Info**	**0.215**	**NO**
Packaged/Processed US Grown US			
Organic Info	Environmental Info	0.034	YES
Organic Info	Organic + Environmental Info	0.080	YES
Organic Info	No Info	0.000	YES
Environmental Info	Organic + Environmental Info	0.686	NO
Environmental Info	No Info	0.009	YES
Organic + Environmental Info	No Info	0.003	YES
Packaged/Processed US Grown England			
Organic Info	Environmental Info	0.077	YES
Organic Info	Organic + Environmental Info	0.195	NO
Organic Info	No Info	0.150	NO
Environmental Info	Organic + Environmental Info	0.611	NO
Environmental Info	No Info	0.766	NO
Organic + Environmental Info	No Info	0.847	NO

First line reads: A two-tailed t-test of equality between Organic Info and Environmental Info for the attribute “100% Organic” + NOP is rejected at the 10% level with a p-value < 0.000

Table 1.8 Pair-wise Equality Tests for MNL Means Across Informational Treatments by Attribute Level

Packaged/Processed US Grown CH		p-value	Reject @ 10%
Organic Info	Environmental Info	0.805	NO
Organic Info	Organic + Environmental Info	0.657	NO
Organic Info	No Info	0.736	NO
Environmental Info	Organic + Environmental Info	0.848	NO
Environmental Info	No Info	0.924	NO
Organic + Environmental Info	No Info	0.928	NO
Packaged/Processed England Grown England			
Organic Info	Environmental Info	0.568	NO
Organic Info	Organic + Environmental Info	0.847	NO
Organic Info	No Info	0.432	NO
Environmental Info	Organic + Environmental Info	0.702	NO
Environmental Info	No Info	0.820	NO
Organic + Environmental Info	No Info	0.547	NO
Packaged/Processed CH Grown England			
Organic Info	Environmental Info	0.691	NO
Organic Info	Organic + Environmental Info	0.271	NO
Organic Info	No Info	0.009	YES
Environmental Info	Organic + Environmental Info	0.488	NO
Environmental Info	No Info	0.025	YES
Organic + Environmental Info	No Info	0.099	YES
Packaged/Processed England Grown CH			
Organic Info	Environmental Info	0.784	NO
Organic Info	Organic + Environmental Info	0.406	NO
Organic Info	No Info	0.037	YES
Environmental Info	Organic + Environmental Info	0.582	NO
Environmental Info	No Info	0.068	YES
Organic + Environmental Info	No Info	0.182	NO
Packaged/Processed CH Grown CH			
Organic Info	Environmental Info	0.783	NO
Organic Info	Organic + Environmental Info	0.208	NO
Organic Info	No Info	0.440	NO
Environmental Info	Organic + Environmental Info	0.331	NO
Environmental Info	No Info	0.617	NO
Organic + Environmental Info	No Info	0.657	NO

First line reads: A two-tailed t-test of equality between Organic Info and Environmental Info for the attribute Packaged/Processed US Grown CH cannot be rejected at the 10% level with a p-value = 0.805

Table 1.9 Pair-wise Equality Tests for MNL Means Across Informational Treatments by Attribute Level different from the no information treatment. Although this result for NOP and Environmentally Friendly is not in line with “100% Organic” + NOP and “Made With Organic Grains”, it still supports the hypothesis that informational treatments do affect consumer choice, but also suggests that more information may not result in larger effects on purchase probability.

1.6.2 Preference Heterogeneity via Random Parameters Logit

We next estimate the same utility model as the MNL using a Random Parameters Logit (RPL) specification. While the MNL results align with expectations, the assumption of identical utility functions across all respondents may not be plausible. The advantage of using a RPL model is that it allows for each respondent to have individual utility coefficients, thus the parameter estimates will incorporate the uniqueness of each respondent and a distribution is estimated for each explanatory variable in the model. Under the RPL specification of normally distributed utility parameter coefficients, a mean and standard deviation for all parameters is estimated using 200 simulated replications. No correlation among parameters is imposed on the model.

As with the MNL specification, each of the 2,382 respondents completed 5 choice experiments resulting in 11,910 choice observations for analysis, where each choice observation consists of 4 possible choices resulting in 47,640 observations. Due to software convergence issues, only price, environmental and organic attributes are estimated as random parameters and all COOL attribute levels are estimated as fixed parameters. Thus all COOL effects are assumed to be homogeneous across respondents, while price, environmental and organic effects are allowed to be heterogeneous.

The estimated means and standard deviations for random parameters are reported in Table 1.10 and the fixed parameter means are presented in Table 1.11 along with the corresponding standard errors, *z*-stats and *p*-values. All random parameter means are significant at the 1% level and all but 2 of the estimated standard deviation are significant at the 1% level. The estimated standard deviations of the random parameters explain

Number of Observations = 47,640	R-squared = 0.235		Log-likelihood = -12,610.83	
Estimated Means in Utility Functions				
Variable	Coeff.	S.E.	z-stat	p-value
PRICE	-0.772	0.022	-35.175	0.000
[“100% Organic” + NOP]*Organic Info	2.146	0.093	23.072	0.000
[“100% Organic” + NOP]*Enviro Info	1.686	0.087	19.351	0.000
[“100% Organic” + NOP]*Organic + Enviro Info	1.968	0.090	21.813	0.000
[“100% Organic” + NOP]*No Info	1.760	0.097	18.107	0.000
[NOP]*Organic Info	1.981	0.084	23.618	0.000
[NOP]*Enviro Info	1.588	0.088	17.960	0.000
[NOP]*Organic + Enviro Info	1.642	0.088	18.754	0.000
[NOP]*No Info	1.624	0.090	18.026	0.000
[“Made With Organic Grains”]*Organic Info	1.381	0.089	15.600	0.000
[“Made With Organic Grains”]*Enviro Info	1.226	0.094	13.100	0.000
[“Made With Organic Grains”]*Organic + Enviro Info	1.264	0.099	12.734	0.000
[“Made With Organic Grains”]*No Info	1.103	0.099	11.096	0.000
[Environmenatlly Friendly Label]*Organic Info	1.183	0.064	18.442	0.000
[Environmenatlly Friendly Label]*Enviro Info	1.378	0.071	19.505	0.000
[Environmenatlly Friendly Label]*Organic + Enviro Info	1.353	0.069	19.735	0.000
[Environmenatlly Friendly Label]*No Info	1.216	0.072	17.003	0.000
Estimated Standard Deviations in Utility Functions				
Variable	Coeff.	S.E.	z-stat	p-value
PRICE	0.339	0.013	25.100	0.000
[“100% Organic” + NOP]*Organic Info	0.914	0.118	7.752	0.000
[“100% Organic” + NOP]*Enviro Info	0.595	0.158	3.769	0.000
[“100% Organic” + NOP]*Organic + Enviro Info	0.843	0.129	6.563	0.000
[“100% Organic” + NOP]*No Info	0.837	0.138	6.084	0.000
[NOP]*Organic Info	0.287	0.239	1.201	0.230
[NOP]*Enviro Info	0.673	0.145	4.655	0.000
[NOP]*Organic + Enviro Info	0.553	0.162	3.409	0.001
[NOP]*No Info	0.418	0.187	2.233	0.026
[“Made With Organic Grains”]*Organic Info	0.381	0.229	1.664	0.096
[“Made With Organic Grains”]*Enviro Info	0.755	0.145	5.196	0.000
[“Made With Organic Grains”]*Organic + Enviro Info	1.044	0.132	7.911	0.000
[“Made With Organic Grains”]*No Info	0.675	0.169	3.999	0.000
[Environmenatlly Friendly Label]*Organic Info	0.673	0.099	6.811	0.000
[Environmenatlly Friendly Label]*Enviro Info	0.867	0.097	8.975	0.000
[Environmenatlly Friendly Label]*Organic + Enviro Info	0.814	0.099	8.250	0.000
[Environmenatlly Friendly Label]*No Info	0.783	0.103	7.608	0.000

Table 1.10 Random Parameter Means and Standard Deviations in Utility Functions

Variable	Coeff.	S.E.	z-stat	p-value
[Processed/Packaged US Grown US]*Organic Info	2.493	0.099	25.138	0.000
[Processed/Packaged US Grown US]*Enviro Info	2.814	0.105	26.884	0.000
[Processed/Packaged US Grown US]*Organic + Enviro Info	2.791	0.103	27.034	0.000
[Processed/Packaged US Grown US]*No Info	3.133	0.110	28.462	0.000
[Processed/Packaged US Grown UK]*Organic Info	1.066	0.100	10.709	0.000
[Processed/Packaged US Grown UK]*Enviro Info	1.261	0.098	12.870	0.000
[Processed/Packaged US Grown UK]*Organic + Enviro Info	1.217	0.098	12.392	0.000
[Processed/Packaged US Grown UK]*No Info	1.242	0.103	12.061	0.000
[Processed/Packaged US Grown CH]*Organic Info	0.245	0.109	2.255	0.024
[Processed/Packaged US Grown CH]*Enviro Info	0.192	0.113	1.690	0.091
[Processed/Packaged US Grown CH]*Organic + Enviro Info	0.158	0.113	1.396	0.163
[Processed/Packaged US Grown CH]*No Info	0.150	0.119	1.257	0.209
[Processed/Packaged UK Grown UK]*Organic Info	0.784	0.102	7.710	0.000
[Processed/Packaged UK Grown UK]*Enviro Info	0.642	0.105	6.124	0.000
[Processed/Packaged UK Grown UK]*Organic + Enviro Info	0.691	0.104	6.626	0.000
[Processed/Packaged UK Grown UK]*No Info	0.614	0.109	5.637	0.000
[Processed/Packaged CH Grown UK]*Organic Info	-0.290	0.121	-2.403	0.016
[Processed/Packaged CH Grown UK]*Enviro Info	-0.375	0.125	-2.987	0.003
[Processed/Packaged CH Grown UK]*Organic + Enviro Info	-0.521	0.127	-4.094	0.000
[Processed/Packaged CH Grown UK]*No Info	-0.839	0.146	-5.746	0.000
[Processed/Packaged UK Grown CH]*Organic Info	0.016	0.114	0.141	0.888
[Processed/Packaged UK Grown CH]*Enviro Info	-0.067	0.119	-0.563	0.573
[Processed/Packaged UK Grown CH]*Organic + Enviro Info	-0.182	0.120	-1.521	0.128
[Processed/Packaged UK Grown CH]*No Info	-0.436	0.134	-3.240	0.001
[Processed/Packaged CH Grown CH]*Organic Info	-0.459	0.126	-3.635	0.000
[Processed/Packaged CH Grown CH]*Enviro Info	-0.556	0.133	-4.188	0.000
[Processed/Packaged CH Grown CH]*Organic + Enviro Info	-0.715	0.135	-5.297	0.000
[Processed/Packaged CH Grown CH]*No Info	-0.677	0.142	-4.776	0.000
Note: UK represents England				

Table 1.11 Non-Random Parameters in Utility Functions

how dispersed the preferences are for these explanatory variables, and the measure of these variations are the result of combining the utility functions across all respondents. In Table 1.10 the NOP label interacted with organic information is the only variable that has an estimated standard deviation that is not statistically different from zero at the 10%

level, suggesting respondents all have a homogeneous preference for the NOP label when exposed to organic information, given the assumption of a normal distribution. In Table 1.11 all but 5 out of 28 fixed parameters have estimated means significantly different from zero at the 10% level.

Tables 1.12 and 1.13 and 1.14 are the RPL equivalent to Tables 1.5 and 1.6 and 1.7 presented in the MNL analysis. In Table 1.12 we see that organic information and the combined organic + environmental information interacted with all three organic attribute levels rank as the highest effects, and environmental information and no information rank last amongst the informational treatments within the organic segment. We also see that when we hold the informational treatment constant and compare estimated means across organic labels, the ordering of preferences is identical to that in the MNL model: "100% Organic + NOP" followed by "NOP" followed by "Made With Organic Grains." These results largely mirror findings from the MNL analysis and further support the association between higher organic content and higher purchase probabilities. The Environmentally Friendly label gets its largest effect when interacted with environmental information and the combined organic + environmental information, and organic and no information interactions have the lowest effects.

Concerning COOL attribute levels in Tables 1.13 and 1.14, there seems to be little pattern concerning the impact of informational treatments on consumer choice, which is also consistent with the MNL results. One would expect that a respondent seeing the organic information, on its own or in conjunction with environmental information, would be more likely to purchase a product compared with respondents receiving no organic

Variable	Coefficient
[“100% Organic” + NOP]*Organic Info	2.146
[“100% Organic” + NOP]*Organic + Enviro Info	1.968
[“100% Organic” + NOP]*No Info	1.760
[“100% Organic” + NOP]*Enviro Info	1.686
[NOP]*Organic Info	1.981
[NOP]*Organic + Enviro Info	1.642
[NOP]*No Info	1.624
[NOP]*Enviro Info	1.588
[“Made With Organic Grains”]*Organic Info	1.381
[“Made With Organic Grains”]*Organic + Enviro Info	1.264
[“Made With Organic Grains”]*Enviro Info	1.226
[“Made With Organic Grains”]*No Info	1.103
[“100% Organic” + NOP]*Organic Info	2.146
[NOP]*Organic Info	1.981
[“Made With Organic Grains”]*Organic Info	1.381
[“100% Organic” + NOP]*Enviro Info	1.686
[NOP]*Enviro Info	1.588
[“Made With Organic Grains”]*Enviro Info	1.226
[“100% Organic” + NOP]*Organic + Enviro Info	1.968
[NOP]*Organic + Enviro Info	1.642
[“Made With Organic Grains”]*Organic + Enviro Info	1.264
[“100% Organic” + NOP]*No Info	1.760
[NOP]*No Info	1.624
[“Made With Organic Grains”]*No Info	1.103
[Environmenatlly Friendly Label]*Enviro Info	1.378
[Environmenatlly Friendly Label]*Organic + Enviro Info	1.353
[Environmenatlly Friendly Label]*No Info	1.216
[Environmenatlly Friendly Label]*Organic Info	1.183

Table 1.12 RPL Results by Organic and Environmental Segments

information. Although the organic information does state that any product, foreign or domestic, must pass all USDA standards if the product is to be sold as organic, this information seems to have no sway over consumer preferences. A further look at Tables

Variable	Coefficient
[Processed/Packaged US Grown US]*No Info	3.133
[Processed/Packaged US Grown US]*Enviro Info	2.814
[Processed/Packaged US Grown US]*Organic + Enviro Info	2.791
[Processed/Packaged US Grown US]*Organic Info	2.493
[Processed/Packaged US Grown UK]*Enviro Info	1.261
[Processed/Packaged US Grown UK]*No Info	1.242
[Processed/Packaged US Grown UK]*Organic + Enviro Info	1.217
[Processed/Packaged US Grown UK]*Organic Info	1.066
[Processed/Packaged US Grown CH]*Organic Info	0.245
[Processed/Packaged US Grown CH]*Enviro Info	0.192
[Processed/Packaged US Grown CH]*Organic + Enviro Info	0.158
[Processed/Packaged US Grown CH]*No Info	0.150
[Processed/Packaged UK Grown UK]*Organic Info	0.784
[Processed/Packaged UK Grown UK]*Organic + Enviro Info	0.691
[Processed/Packaged UK Grown UK]*Enviro Info	0.642
[Processed/Packaged UK Grown UK]*No Info	0.614
[Processed/Packaged CH Grown UK]*Organic Info	-0.290
[Processed/Packaged CH Grown UK]*Enviro Info	-0.375
[Processed/Packaged CH Grown UK]*Organic + Enviro Info	-0.521
[Processed/Packaged CH Grown UK]*No Info	-0.839
[Processed/Packaged UK Grown CH]*Organic Info	0.016
[Processed/Packaged UK Grown CH]*Enviro Info	-0.067
[Processed/Packaged UK Grown CH]*Organic + Enviro Info	-0.182
[Processed/Packaged UK Grown CH]*No Info	-0.436
[Processed/Packaged CH Grown CH]*Organic Info	-0.459
[Processed/Packaged CH Grown CH]*Enviro Info	-0.556
[Processed/Packaged CH Grown CH]*No Info	-0.677
[Processed/Packaged CH Grown CH]*Organic + Enviro Info	-0.715
Note: UK represents England	

Table 1.13 RPL Results by COOL Segment

1.13 and 1.14 shows the homogeneous effects organized by informational treatments. Purely U.S. products induce the highest probability of purchase while purely Chinese products decrease purchase probability. The same pattern emerges from the RPL results as the MNL results in that, purely U.S. and English, as well as mixed U.S.-English

Variable	Coefficient
[Processed/Packaged US Grown US]*Organic Info	2.493
[Processed/Packaged US Grown UK]*Organic Info	1.066
[Processed/Packaged UK Grown UK]*Organic Info	0.784
[Processed/Packaged US Grown CH]*Organic Info	0.245
[Processed/Packaged UK Grown CH]*Organic Info	0.016
[Processed/Packaged CH Grown UK]*Organic Info	-0.290
[Processed/Packaged CH Grown CH]*Organic Info	-0.459
[Processed/Packaged US Grown US]*Enviro Info	2.814
[Processed/Packaged US Grown UK]*Enviro Info	1.261
[Processed/Packaged UK Grown UK]*Enviro Info	0.642
[Processed/Packaged US Grown CH]*Enviro Info	0.192
[Processed/Packaged UK Grown CH]*Enviro Info	-0.067
[Processed/Packaged CH Grown UK]*Enviro Info	-0.375
[Processed/Packaged CH Grown CH]*Enviro Info	-0.556
[Processed/Packaged US Grown US]*Organic + Enviro Info	2.791
[Processed/Packaged US Grown UK]*Organic + Enviro Info	1.217
[Processed/Packaged UK Grown UK]*Organic + Enviro Info	0.691
[Processed/Packaged US Grown CH]*Organic + Enviro Info	0.158
[Processed/Packaged UK Grown CH]*Organic + Enviro Info	-0.182
[Processed/Packaged CH Grown UK]*Organic + Enviro Info	-0.521
[Processed/Packaged CH Grown CH]*Organic + Enviro Info	-0.715
[Processed/Packaged US Grown US]*No Info	3.133
[Processed/Packaged US Grown UK]*No Info	1.242
[Processed/Packaged UK Grown UK]*No Info	0.614
[Processed/Packaged US Grown CH]*No Info	0.150
[Processed/Packaged UK Grown CH]*No Info	-0.436
[Processed/Packaged CH Grown CH]*No Info	-0.677
[Processed/Packaged CH Grown UK]*No Info	-0.839
Note: UK represents England	

Table 1.14 RPL Results by COOL Segment

products all have a positive effect on purchase probability, while any product where China is listed as a packager/processer or grower of ingredients has a negative effect on purchase probability.

A closer look at Table 1.14 (and Table 1.7 in MNL results) reveals that a purely Chinese product is always ranked last except for when respondents receive the no information treatment. Also we can see that a product processed/packaged in China with grains grown in England is always ranked lower than a product processed/packaged in England with grains grown in China. This may suggest that including England as either a processer/packager or grower has the effect of removing some of the negative impact that China has in the production process. Furthermore, the results indicate that English processing/packaging removes more of the negative stigma associated with Chinese goods than does English involvement in growing the grain.

This result suggests that consumers are most concerned with the country of "last touch" in the development of this food product. The possibility for negative outcomes in this food product comes from the growing of ingredients, and subsequently the processing and packaging of the grains into the final product for consumption. Assuming that respondents view England as a positive source of value and China as a source of negative value, the results suggest that consumers are more likely to trust England to process and package potentially harmful grains from China into a product safe for consumption than they are to trust China to take safe grains from England and process and package them into a product safe for consumption.

In order to test our hypothesis that informational treatments affect consumer buying behavior, we conduct exhaustive pair-wise t-tests of mean coefficients in Tables 1.15 and 1.16. The null hypothesis is that within each attribute level, different information treatment interactions will have no impact on the difference in random

100% Organic + NOP		p-value	Reject @ 10%
Organic Info	Environmental Info	0.000	YES
Organic Info	Organic + Environmental Info	0.148	YES
Organic Info	**No Info**	**0.003**	**YES**
Environmental Info	Organic + Environmental Info	0.020	YES
Environmental Info	No Info	0.551	NO
Organic + Environmental Info	**No Info**	**0.100**	**YES**
NOP			
Organic Info	Environmental Info	0.001	YES
Organic Info	Organic + Environmental Info	0.004	YES
Organic Info	**No Info**	**0.003**	**YES**
Environmental Info	Organic + Environmental Info	0.648	NO
Environmental Info	No Info	0.758	NO
Organic + Environmental Info	**No Info**	**0.885**	**NO**
Made With Organic Grains			
Organic Info	Environmental Info	0.214	NO
Organic Info	Organic + Environmental Info	0.364	NO
Organic Info	**No Info**	**0.033**	**YES**
Environmental Info	Organic + Environmental Info	0.771	NO
Environmental Info	No Info	0.353	NO
Organic + Environmental Info	**No Info**	**0.238**	**NO**
Environmentally Friendly			
Organic Info	Environmental Info	0.032	YES
Organic Info	Organic + Environmental Info	0.057	YES
Organic Info	No Info	0.711	NO
Environmental Info	Organic + Environmental Info	0.786	NO
Environmental Info	**No Info**	**0.091**	**YES**
Organic + Environmental Info	**No Info**	**0.146**	**NO**
Packaged/Processed US Grown US			
Organic Info	Environmental Info	0.017	YES
Organic Info	Organic + Environmental Info	0.026	YES
Organic Info	No Info	0.000	YES
Environmental Info	Organic + Environmental Info	0.859	NO
Environmental Info	No Info	0.025	YES
Organic + Environmental Info	No Info	0.016	YES
Packaged/Processed US Grown England			
Organic Info	Environmental Info	0.144	NO
Organic Info	Organic + Environmental Info	0.256	NO
Organic Info	No Info	0.199	NO
Environmental Info	Organic + Environmental Info	0.739	NO
Environmental Info	No Info	0.886	NO
Organic + Environmental Info	No Info	0.856	NO

First line reads: A two-tailed t-test of equality between Organic Info and Environmental Info for the attribute “100% Organic” + NOP is rejected at the 10% level with a p-value < 0.000

Table 1.15 Pair-wise Equality Tests for RPL Means Across Informational Treatments by Attribute Level

Packaged/Processed US Grown CH		p-value	Reject @ 10%
Organic Info	Environmental Info	0.728	NO
Organic Info	Organic + Environmental Info	0.569	NO
Organic Info	No Info	0.545	NO
Environmental Info	Organic + Environmental Info	0.828	NO
Environmental Info	No Info	0.794	NO
Organic + Environmental Info	No Info	0.959	NO
Packaged/Processed England Grown England			
Organic Info	Environmental Info	0.317	NO
Organic Info	Organic + Environmental Info	0.512	NO
Organic Info	No Info	0.240	NO
Environmental Info	Organic + Environmental Info	0.730	NO
Environmental Info	No Info	0.846	NO
Organic + Environmental Info	No Info	0.594	NO
Packaged/Processed CH Grown England			
Organic Info	Environmental Info	0.624	NO
Organic Info	Organic + Environmental Info	0.187	NO
Organic Info	No Info	0.005	YES
Environmental Info	Organic + Environmental Info	0.409	NO
Environmental Info	No Info	0.018	YES
Organic + Environmental Info	No Info	0.101	NO
Packaged/Processed England Grown CH			
Organic Info	Environmental Info	0.607	NO
Organic Info	Organic + Environmental Info	0.224	NO
Organic Info	No Info	0.011	YES
Environmental Info	Organic + Environmental Info	0.488	NO
Environmental Info	No Info	0.041	YES
Organic + Environmental Info	No Info	0.157	NO
Packaged/Processed CH Grown CH			
Organic Info	Environmental Info	0.591	NO
Organic Info	Organic + Environmental Info	0.164	NO
Organic Info	No Info	0.248	NO
Environmental Info	Organic + Environmental Info	0.399	NO
Environmental Info	No Info	0.531	NO
Organic + Environmental Info	No Info	0.845	NO

First line reads: A two-tailed t-test of equality between Organic Info and Environmental Info for the attribute Packaged/Processed US Grown CH cannot be rejected at the 10% level with a p-value = 0.782

Table 1.16 Pair-wise Equality Tests for RPL Means Across Informational Treatments by Attribute Level parameter distribution means, thus all means should be equal. Referring to Table 1.15 and focusing on bolded entries, we see that all relevant hypothesis tests are rejected for organic and environment attributes. Thus the central hypothesis of this paper is supported within the RPL framework: informational treatments do have a significant effect on consumer choice. The proportion of hypotheses rejected in Table 1.16 is nearly identical to the proportion in Table 1.9, suggesting consistency in results between the two approaches.

In addition to informational treatment having an effect on the estimated mean of attributes in utility functions, there is also an effect on the estimated standard deviations. Table 1.17 presents the estimated means, standard deviations and the ratio of means to standard deviations for all random parameters, organized by attribute. We focus on the last column in Table 1.17 as we are concerned with the estimated mean relative to the estimated standard deviation, or the coefficient of variation, which standardizes parameter variability. In general, "Made With Organic Grains" has the highest variability relative to all other attributes, followed by the Environmentally Friendly label, then the NOP label and lastly by "100% Organic" + NOP label. A likely explanation for this ordering is that the preference heterogeneity for a product label may be related to the amount and quality of information communicated by the label. For example, in no case does an organic information treatment generate more parameter variability than does an information treatment featuring both organic and environmental information. When a consumer sees the three organic attribute levels side-by-side, the label "100% Organic" + NOP clearly reveals the level of organic content and certification, the NOP label reveals

Variable	Mean	SD	SD/Mean
PRICE	-0.772	0.339	0.438
[“100% Organic” + NOP]*No Info	1.760	0.837	0.475
[“100% Organic” + NOP]*Organic + Enviro Info	1.968	0.843	0.428
[“100% Organic” + NOP]*Organic Info	2.146	0.914	0.426
[“100% Organic” + NOP]*Enviro Info	1.686	0.595	0.353
[NOP]*Enviro Info	1.588	0.673	0.424
[NOP]*Organic + Enviro Info	1.642	0.553	0.337
[NOP]*No Info	1.624	0.418	0.257
[NOP]*Organic Info	1.981	0.287	0.145
[“Made With Organic Grains”]*Organic + Enviro Info	1.264	1.044	0.826
[“Made With Organic Grains”]*Enviro Info	1.226	0.755	0.616
[“Made With Organic Grains”]*No Info	1.103	0.675	0.612
[“Made With Organic Grains”]*Organic Info	1.381	0.381	0.276
[Environmenatlly Friendly Label]*No Info	1.216	0.783	0.644
[Environmenatlly Friendly Label]*Enviro Info	1.378	0.867	0.629
[Environmenatlly Friendly Label]*Organic + Enviro Info	1.353	0.814	0.602
[Environmenatlly Friendly Label]*Organic Info	1.183	0.673	0.569

Table 1.17 Random Parameter Estimated Means and Standard Deviations

some level of organic content and certification, and “Made With Organic Grains” communicates some level of organic content without certification. Therefore, the label with the most information communicated to the consumer should have the lowest level of heterogeneity amongst consumers, all else being equal.

In Table 1.18 a pair-wise *t*-test is calculated across informational treatments for organic attributes and environmental treatment attributes and tests for the equality of estimated standard deviation parameters. Equality of parameters cannot be rejected for 22 out of 24 tests performed and indicates that the standard deviations themselves, not necessarily the coefficients of variation, are largely statistically similar across informational treatments. So, while organic information treatments always generate smaller standard deviation parameters for all levels of organic products, only in one case ("Made With Organic Grains") is the standard deviation parameter significantly smaller.

100% Organic + NOP		p-value	Reject @ 10%
Organic Info	Environmental Info	0.109	NO
Organic Info	Organic + Environmental Info	0.687	NO
Organic Info	No Info	0.670	NO
Environmental Info	Organic + Environmental Info	0.229	NO
Environmental Info	No Info	0.252	NO
Organic + Environmental Info	No Info	0.973	NO
NOP			
Organic Info	Environmental Info	0.174	NO
Organic Info	Organic + Environmental Info	0.364	NO
Organic Info	No Info	0.669	NO
Environmental Info	Organic + Environmental Info	0.580	NO
Environmental Info	No Info	0.284	NO
Organic + Environmental Info	No Info	0.588	NO
Made With Organic Grains			
Organic Info	Environmental Info	0.175	NO
Organic Info	Organic + Environmental Info	0.015	YES
Organic Info	No Info	0.305	NO
Environmental Info	Organic + Environmental Info	0.144	NO
Environmental Info	No Info	0.722	NO
Organic + Environmental Info	No Info	0.091	YES
Environmentally Friendly			
Organic Info	Environmental Info	0.162	NO
Organic Info	Organic + Environmental Info	0.315	NO
Organic Info	No Info	0.443	NO
Environmental Info	Organic + Environmental Info	0.698	NO
Environmental Info	No Info	0.555	NO
Organic + Environmental Info	No Info	0.832	NO

First line reads: A two-tailed t-test of equality between Organic Info and Environmental Info for the attribute "100% Organic" + NOP cannot be rejected at the 10% level with a p-value = 0.109

Table 1.18 Pair-wise Equality Tests for RPL Standard Deviations Across Informational Treatments by Attribute Level

1.6.3 MNL vs. RPL and WTP Measures

Although the results have a similar pattern between MNL and RPL estimation frameworks, the model fit to the data must be assessed relative to each other. The MNL model is estimated first to compute starting values for the RPL simulation, and then the RPL model is estimated. The log-likelihood of the MNL model is -13,053.15 and the log-likelihood of the nested model is -12,610.83. The log-likelihood ratio test, which tests the hypothesis that the dispersion parameters are jointly equal to zero, has a chi-squared test statistic of 7,799 with 62 degrees of freedom and is rejected at a p-value < 0.001, suggesting that there is significant preference heterogeneity amongst the respondents not being captured by the MNL model.

The WTP calculations for the MNL model are presented in Table 1.19 and WTP calculations for the RPL model are presented in Table 1.20. There is little difference in the central tendency of WTP across the two methods, but the difference in 95% confidence intervals is quite large. From the RPL model, the WTP for all organic content and environmentally friendly attributes have 95% confidence intervals that contain negative values while WTP measures from the MNL model do not. This difference in confidence intervals stems from the difference in model assumptions regarding preferences: the MNL model assumes preference homogeneity while the RPL model allows each individual to have unique preferences for each product attribute. Further, the RPL confidence intervals take into consideration not only preference heterogeneity, but also imprecision (standard errors and related covariance) of four different coefficients,

Product Attribute	WTP	se(WTP)	.95 CI LB	.95 CI UP
[“100% Organic” + NOP]*Organic Info	2.86	0.155	2.55	3.16
[“100% Organic” + NOP]*Enviro Info	2.15	0.140	1.88	2.43
[“100% Organic” + NOP]*Organic + Enviro Info	2.56	0.147	2.27	2.85
[“100% Organic” + NOP]*No Info	2.30	0.148	2.01	2.59
[NOP]*Organic Info	2.53	0.149	2.24	2.83
[NOP]*Enviro Info	2.07	0.138	1.80	2.34
[NOP]*Organic + Enviro Info	2.12	0.139	1.84	2.39
[NOP]*No Info	2.04	0.143	1.76	2.32
[“Made With Organic Grains”]*Organic Info	1.74	0.137	1.47	2.01
[“Made With Organic Grains”]*Enviro Info	1.63	0.132	1.37	1.89
[“Made With Organic Grains”]*Organic + Enviro Info	1.75	0.134	1.49	2.01
[“Made With Organic Grains”]*No Info	1.39	0.137	1.12	1.66
[Environmenatlly Friendly Label]*Organic Info	1.46	0.096	1.27	1.65
[Environmenatlly Friendly Label]*Enviro Info	1.74	0.104	1.54	1.94
[Environmenatlly Friendly Label]*Organic + Enviro Info	1.67	0.101	1.47	1.86
[Environmenatlly Friendly Label]*No Info	1.54	0.103	1.34	1.74
[Processed/Packaged US Grown US]*Organic Info	3.08	0.172	2.74	3.42
[Processed/Packaged US Grown US]*Enviro Info	3.43	0.181	3.08	3.78
[Processed/Packaged US Grown US]*Organic + Enviro Info	3.36	0.178	3.02	3.71
[Processed/Packaged US Grown US]*No Info	3.88	0.195	3.50	4.27
[Processed/Packaged US Grown UK]*Organic Info	1.18	0.144	0.89	1.46
[Processed/Packaged US Grown UK]*Enviro Info	1.49	0.146	1.20	1.77
[Processed/Packaged US Grown UK]*Organic + Enviro Info	1.40	0.143	1.12	1.68
[Processed/Packaged US Grown UK]*No Info	1.44	0.150	1.14	1.73
[Processed/Packaged US Grown CH]*Organic Info	0.08	0.148	-0.21	0.37
[Processed/Packaged US Grown CH]*Enviro Info	0.03	0.152	-0.27	0.33
[Processed/Packaged US Grown CH]*Organic + Enviro Info	-0.01	0.149	-0.30	0.28
[Processed/Packaged US Grown CH]*No Info	0.01	0.160	-0.30	0.32
[Processed/Packaged UK Grown UK]*Organic Info	0.78	0.143	0.50	1.06
[Processed/Packaged UK Grown UK]*Enviro Info	0.67	0.144	0.39	0.95
[Processed/Packaged UK Grown UK]*Organic + Enviro Info	0.74	0.142	0.46	1.02
[Processed/Packaged UK Grown UK]*No Info	0.63	0.149	0.34	0.92
[Processed/Packaged CH Grown UK]*Organic Info	-0.60	0.162	-0.92	-0.29
[Processed/Packaged CH Grown UK]*Enviro Info	-0.70	0.167	-1.02	-0.37
[Processed/Packaged CH Grown UK]*Organic + Enviro Info	-0.86	0.165	-1.18	-0.54
[Processed/Packaged CH Grown UK]*No Info	-1.29	0.195	-1.67	-0.91

Note: UK represents England

Continued

Table 1.19 MNL Willingness to Pay

Table 1.19 Continued

Product Attribute	WTP	se(WTP)	.95 CI LB	.95 CI UP
[Processed/Packaged UK Grown CH]*Organic Info	-0.24	0.155	-0.54	0.06
[Processed/Packaged UK Grown CH]*Enviro Info	-0.30	0.158	-0.61	0.01
[Processed/Packaged UK Grown CH]*Organic + Enviro Info	-0.42	0.156	-0.73	-0.12
[Processed/Packaged UK Grown CH]*No Info	-0.74	0.177	-1.08	-0.39
[Processed/Packaged CH Grown CH]*Organic Info	-0.87	0.170	-1.21	-0.54
[Processed/Packaged CH Grown CH]*Enviro Info	-0.94	0.176	-1.29	-0.60
[Processed/Packaged CH Grown CH]*Organic + Enviro Info	-1.19	0.179	-1.54	-0.84
[Processed/Packaged CH Grown CH]*No Info	-1.07	0.189	-1.44	-0.70

Note: UK represents England

while the MNL confidence intervals only take into consideration the imprecision of two model coefficients and the single covariance of these two estimates.

Thus, the RPL model shows that for some individuals there is a disutility for certain product attributes that the MNL model does not capture. In the last column of Table 1.20, the percentage of respondents that have zero or positive WTP for the product attribute in the RPL model is presented, and we see that for many product attributes the vast majority of respondents have a positive WTP for attributes that are expected to provide positive utility to the consumer. Because the RPL model more accurately reflects the preferences of the respondent group, the WTP estimates from the RPL model are used in the remainder of discussion.

Overall, the highest WTP comes from a label stating that the product is purely from the U.S. This result needs to be taken with caution: the experiment uses China and England as countries of origin for comparison and the experimental setting may be more extreme than a typical grocery shopping experience. The results are consistent with a

Product Attribute	WTP	se(WTP)	.95 CI LB	.95 CI UP	% WTP>0
[“100% Organic” + NOP]*Organic Info	2.76	1.717	-0.61	6.12	94.6%
[“100% Organic” + NOP]*Enviro Info	2.15	1.242	-0.28	4.59	95.9%
[“100% Organic” + NOP]*Organic + Enviro Info	2.51	1.562	-0.55	5.58	94.6%
[“100% Organic” + NOP]*No Info	2.23	1.493	-0.70	5.16	93.2%
[NOP]*Organic Info	2.53	1.228	0.12	4.94	98.0%
[NOP]*Enviro Info	2.03	1.264	-0.45	4.50	94.6%
[NOP]*Organic + Enviro Info	2.08	1.172	-0.22	4.37	96.2%
[NOP]*No Info	2.06	1.085	-0.06	4.19	97.1%
[“Made With Organic Grains”]*Organic Info	1.76	0.980	-0.16	3.68	96.4%
[“Made With Organic Grains”]*Enviro Info	1.56	1.228	-0.85	3.97	89.8%
[“Made With Organic Grains”]*Organic + Enviro Info	1.59	1.585	-1.51	4.70	84.3%
[“Made With Organic Grains”]*No Info	1.56	1.581	-1.54	4.66	83.8%
[Environmenatlly Friendly Label]*Organic Info	1.50	1.118	-0.69	3.69	91.0%
[Environmenatlly Friendly Label]*Enviro Info	1.74	1.388	-0.98	4.46	89.5%
[Environmenatlly Friendly Label]*Organic + Enviro Info	1.72	1.324	-0.87	4.31	90.3%
[Environmenatlly Friendly Label]*No Info	1.55	1.253	-0.91	4.00	89.1%
[Processed/Packaged US Grown US]*Organic Info	3.17	1.399	0.43	5.91	98.8%
[Processed/Packaged US Grown US]*Enviro Info	3.60	1.601	0.46	6.73	98.8%
[Processed/Packaged US Grown US]*Organic + Enviro Info	3.56	1.583	0.45	6.66	98.8%
[Processed/Packaged US Grown US]*No Info	3.99	1.773	0.52	7.47	98.8%
[Processed/Packaged US Grown UK]*Organic Info	1.36	0.615	0.16	2.57	98.7%
[Processed/Packaged US Grown UK]*Enviro Info	1.61	0.722	0.19	3.02	98.7%
[Processed/Packaged US Grown UK]*Organic + Enviro Info	1.56	0.700	0.18	2.93	98.7%
[Processed/Packaged US Grown UK]*No Info	1.58	0.711	0.19	2.98	98.7%
[Processed/Packaged US Grown CH]*Organic Info	0.31	0.196	-0.07	0.70	94.5%
[Processed/Packaged US Grown CH]*Enviro Info	0.24	0.179	-0.11	0.59	91.2%
[Processed/Packaged US Grown CH]*Organic + Enviro Info	0.20	0.171	-0.13	0.54	88.2%
[Processed/Packaged US Grown CH]*No Info	0.19	0.174	-0.15	0.53	86.3%
[Processed/Packaged UK Grown UK]*Organic Info	1.00	0.459	0.10	1.90	98.5%
[Processed/Packaged UK Grown UK]*Enviro Info	0.82	0.386	0.06	1.58	98.3%
[Processed/Packaged UK Grown UK]*Organic + Enviro Info	0.88	0.409	0.08	1.68	98.4%
[Processed/Packaged UK Grown UK]*No Info	0.79	0.377	0.05	1.53	98.2%
[Processed/Packaged CH Grown UK]*Organic Info	-0.37	0.228	-0.82	0.08	5.2%
[Processed/Packaged CH Grown UK]*Enviro Info	-0.48	0.267	-1.00	0.05	3.7%
[Processed/Packaged CH Grown UK]*Organic + Enviro Info	-0.67	0.340	-1.33	0.00	2.5%
[Processed/Packaged CH Grown UK]*No Info	-1.06	0.508	-2.06	-0.07	1.8%

Note: UK represents England

Continued

Table 1.20 RPL Willingness to Pay

Table 1.20 Continued

Product Attribute	WTP	se(WTP)	.95 CI LB	.95 CI UP	% WTP>0
[Processed/Packaged UK Grown CH]*Organic Info	0.02	0.147	-0.27	0.31	55.5%
[Processed/Packaged UK Grown CH]*Enviro Info	-0.09	0.159	-0.40	0.23	29.5%
[Processed/Packaged UK Grown CH]*Organic + Enviro Info	-0.23	0.188	-0.60	0.13	10.7%
[Processed/Packaged UK Grown CH]*No Info	-0.56	0.305	-1.16	0.04	3.4%
[Processed/Packaged CH Grown CH]*Organic Info	-0.59	0.309	-1.19	0.02	2.9%
[Processed/Packaged CH Grown CH]*Enviro Info	-0.71	0.359	-1.41	-0.01	2.4%
[Processed/Packaged CH Grown CH]*Organic + Enviro Info	-0.92	0.444	-1.78	-0.05	2.0%
[Processed/Packaged CH Grown CH]*No Info	-0.86	0.426	-1.70	-0.03	2.1%

Note: UK represents England

strong aversion to food products from China by the respondents as the tradeoff between the U.S. and China is larger than the tradeoff between the U.S. and England. The purely U.S. product has the largest WTP, suggesting that consumers, at the time this survey was administered, made food safety their top priority when making a choice.

The organic content attribute “100% Organic + NOP” garners an average premium of $2.76 when organic information is presented and $2.23 with no organic information, which is a respective 78.7% and 63.7% increase over the $3.50 base price. The NOP logo by itself commands a premium of $2.53 when organic information is present and $2.06 when no information is present. Further, the WTP for NOP is less dispersed, particularly when organic information is provided, suggesting that information not only increases consumer WTP, but it also creates a tighter distribution of WTP. We can see that there is a premium overlap between the two organic attributes that have the NOP label: a product with just the NOP label and an organic informational prompt gets a higher premium than a product with the NOP label and 100% organic claim with no informational prompt. The “Made With Organic Grains” label also has a positive WTP and shows no overlap with the NOP or “100% Organic” + NOP attributes, and supports the idea that more organic content commands a higher WTP.

The organic informational treatment states that in order for a product to carry the NOP seal the product must contain at least 95% organic ingredients and that in order for a product to make any organic claim, the organic content must be at least 70%. Thus if a consumer’s WTP is linear in organic content, one would be willing to pay more for an increase from “Made With Organic Grains” to a product with the NOP label, than for an increase from only the NOP label to a “100% Organic” + NOP label. The consumer would be gaining a potential increase from 70% to 95%, which is a 35.7% increase in organic content, as opposed to an increase from 95% to 100%, which is a 5.3% increase in organic content. In Table 1.21 the percentage changes in WTP from “Made With Organic Grains” to NOP and from NOP to “100% Organic” + NOP are presented by informational treatment group. Although none of the changes in WTP by informational treatment reflect the exact 35.7% and 5.3% changes in organic content, we do see that increases in WTP follow the respective increases in organic content.

The eco-label receives premiums ranging from $1.50 to $1.74 and environmental information raises a respondent’s WTP by 12.3% over the WTP of a respondent that receives no information. We see that products that do not have Chinese involvement will have a positive WTP and that respondents would need to be paid up to $0.92 to choose a purely Chinese product. Again, there is evidence of strong aversion to Chinese involvement in processed food at any stage of production.

Variable	WTP ($)	% increase for NOP	% increase for 100% Organic
[“100% Organic” + NOP]*Organic Info	2.78	44%	8%
[NOP]*Organic Info	2.57		
[“Made With Organic Grains”]*Organic Info	1.79		
[“100% Organic” + NOP]*Organic + Enviro Info	2.55	30%	20%
[NOP]*Organic + Enviro Info	2.13		
[“Made With Organic Grains”]*Organic + Enviro Info	1.64		
[“100% Organic” + NOP]*Enviro Info	2.18	30%	6%
[NOP]*Enviro Info	2.06		
[“Made With Organic Grains”]*Enviro Info	1.59		
[“100% Organic” + NOP]*No Info	2.28	47%	8%
[NOP]*No Info	2.10		
[“Made With Organic Grains”]*No Info	1.43		

Table 1.21 Changes in Willingness to Pay for RPL Model

Section 1.7 Conclusion

Estimates from both MNL and RPL models suggest that there are significant differences in WTP for product attributes regarding organic content labeling, eco-labeling and country of origin labeling. This research also shows that when consumers are provided with information regarding organic and environmental labeling, they have an increased WTP for products that display the respective labeling. All else equal, a product displaying “100% Organic” and the NOP symbol receives a $2.23 premium over a product with no labeling, and the identical product receives a premium of $2.76 if the consumer has been prompted with information regarding organic labeling. This is a marked $0.53 difference due to an informational prompt. The same calculations over the NOP label and “Made With Organic Grains” are $0.47 and $0.20 respectively, suggesting possible additional premiums for organic food due to better consumer information. Organic foods producers, sellers and marketers may find value in further educating consumers about the details supporting the NOP symbol and what the USDA guidelines for organic foods are in order to access this additional consumer willingness to pay.

The results from the random parameters logit model also provide some insight into the role of information on the dispersion of preferences, which has not been investigated in the received literature. When provided information about the details of the organic certification program, respondents also tended to display less dispersion in the preference parameters linked to organic products. However, environmental information, when provided either alone or in combination with the organic program information, tended to create more dispersed preference parameters for products with environmentally friendly labels.

In terms of organic attribute levels and product under evaluation, the study by Batte et al. (2007) is the closest paper with results comparable to this one. Batte et al. (2007) used a breakfast cereal labeled with identical organic attributes as this paper and found premiums ranging between 8.3% for a generic organic claim, 10.8% for the NOP label and 15.1% for a 100% organic claim and the NOP label. This study reports much higher premiums with respective 44.6%, 59%, and 63.7% premiums for those respondents who received no informational prompt. While the organic claims and products are identical across the studies, significant differences arise between these two studies that may cause the large discrepancy in estimated premiums. Batte et al. (2007) used a contingent valuation preference elicitation method that required participants to state the number of cents they would pay over a $3 box of cereal in specified intervals. Furthermore, the highest interval offered was an open-ended statement of paying $1 or more over the $3 price of cereal, thus a maximum 33.3% premium could be estimated as a result of the experimental design.

In contrast, this study used a choice experiment in which consumers made trade-offs between various attributes including organic content and price, and price stimuli ranged such that the highest price was nearly 70% higher than the lowest price. Another key difference between these two papers is the sampled data. Batte et al. (2007) used a sample taken in 2003 from the state of Ohio and is a combination of consumer intercept, in person surveys and consumer intercept take home surveys, while this paper employs a national sample taken in 2011 and uses an online survey format. It may be that Ohioans have a systematically lower WTP for organic attributes when compared with the nation and that consumer preferences have significantly changed in the 8 years between the two data collection time periods. Batte et al. (2007) also finds that knowledge of the NOP seal is a positive determinant in explaining the WTP for organic attributes and this study finds that organic informational prompts positively shift consumers WTP for organic attributes. Although the premium results are different, we still see that consumers are willing to pay more for more organic content, and that prior awareness and informational prompts regarding the NOP seal do results in higher WTP for organic foods.

Ehmke et al. (2008) investigates how GMO, pesticide and COOL attributes of onions affect consumer choice. The most comparable results to this study are in regard to COOL, and shows that respondents from Indiana and Kansas will pay premiums between 29% and 42% for onions sourced from the U.S. when compared with onions from France, China and Niger, while this study shows that respondents will pay premiums between 92% and 116% for a breakfast cereal purely produced within the U.S. The results of this paper are much higher than those of Ehmke et al. (2008), and this may be due to significant differences in methodology and sample. Ehmke et al. (2008) uses a total data sample of 346 individuals across 5 countries and estimates an ordered probit model that assumes preference homogeneity, while this paper uses a much larger sample, a different product with different attribute levels, and estimates models that allow for preference heterogeneity. Although the differences between papers are significant, both show that respondents get higher utility from consuming edible products that are produced within their own country.

The results of this essay suggest that consumers are willing to pay significant premiums for organic products, that greater organic content that is communicated via governmental certification increases these premiums, and that when consumers are prompted with information regarding governmental certification, premiums rise higher. Furthermore, consumers' willingness to pay for varying levels of organic content is roughly linear in the change in organic content. It is also found that consumers will pay premiums for products that claim to be more environmentally friendly, thus it may be profitable for food suppliers to label products with stronger environmental attributes accordingly.

Future research might refine our understanding of how a country's reputation interacts with its position in the supply chain of food products to affect consumers' perceived value. If it is consistently found that the country of origin for processing and packaging, and not the source of ingredients, has the most impact in a consumer's decision making process, it may be profitable to source organic food ingredients from countries with lower costs of production (and likely lower standing in consumer perceptions), and process the final product in a country with higher costs of production (and likely higher standing in consumer perceptions). As product labeling regulations regarding organic content, environmental and country of origin evolve, the hypothetical labels used in this essay may approximate actual market conditions, and the premiums estimated within this essay should be re-examined and re-tested to see how much consumers are willing to pay for products with these labels.

Essay 2: A Meta-Analysis of Willingness to Pay for Organic Foods

Section 2.1 Introduction

Organic foods have become widely available for purchase in the US and around the world. Once available only in farmers markets and specialty stores in the US, organic food sales have risen from $11 billion in 2004 to $27 billion in 2012 and represent a growth leader in the US food sector (USDA, ERS, 2013). In the European Union, annual growth for organic product sales is between 10 and 15% (European Commission, Agriculture and Rural Development) and the UK has seen organic sales grow from £750 million in 2000 to £1.667 billion in 2011 (Department for Environment, Food & Rural Affairs). As consumers spend more every year on organic foods and as detailed consumer data concerning organic purchase and consumption has become more available, published, peer-reviewed research regarding who purchases organic foods, how much they are willing to pay and which aspects of organic foods are most important in buying decisions has proliferated.

Since the 1990s, an increasing number of empirical research papers focused on consumer decisions concerning organic foods have been published. Several authors have provided qualitative assessments of this literature (Bonti-Ankomah, Martin and Yirode (2005), Honkanen, Verplanken and Olsen (2006), Aertsens et al. (2009) and Hamm et al. (2012)) and have discussed the predominant categories of organic foods research, and key time trends within these categories. In contrast to this qualitative literature, in this essay I use meta-analysis, a quantitative method, to summarize the extant literature's assessment of consumer willingness to pay (WTP) for organic products.

A preliminary review of the received literature shows that there is significant variation in WTP estimates for organic foods: from a premium of 103% on celery (Estes and Smith, 1996) to a 3.4% premium on jam (Hu et al., 2011). One article even reports a significant discount of 8% on cream (Griffith and Lars, 2009). It is the central interest of this paper to explain these variations of WTP estimates using meta-regression techniques. Several meta-analyses have been published on related aspects of food, including Lusk et al. (2005), GM content; Cicia and Colantuoni (2010), meat traceability; Lagerkvist and Hess (2011), animal welfare; Ehmke (2006), country of origin; Moser, Raffaelli and Thilmany-McFadden (2011), produce credence attributes; and Florax, Travisi and Nijkamp (2005), pesticide levels. To date, however, I am unaware of any meta-analysis of organic WTP estimates, and thus this paper will contribute to the literature by providing insights into the variation across different studies of consumer WTP for organic products.

I follow the classification of heterogeneity proposed by Christensen (2003) and reiterated by Nelson and Kennedy (2009), that differences between study effects may come from two sources: methodological and factual. Factual differences come from real differences in the data. For example, the WTP for organic foods may be different between samples drawn from California and Idaho and between vegetables and meat. Methodological differences arise from differences in methodology and experimental design governing elicitations and estimation of the WTP effect, for example, we might expect differences to arise when one paper uses hypothetical contingent valuation design and another paper uses a choice experiment with binding financial incentives. In this paper I look for both sources of heterogeneity in the WTP data. The data includes a sample of 29 papers published over 17 years that yields 132 observations of consumer WTP used in the analysis.

Following this section I discuss the data collection, transformation and coding; the estimation approach; results; and concluding remarks.

Section 2.2 Data

The search for research featuring WTP estimates was conducted with various search engines including EconLit, JStor and Google Scholar. Key words used in the search included "organic," "willingness to pay," "survey," "premium," "preference," etc. and combinations of these terms. These searches yielded papers in which a WTP estimate for organic food was present, including published, unpublished/working and governmental papers. To ensure a uniform basis of quality among WTP estimates, my analysis features only those papers appearing in peer-reviewed journals and those published by governmental agencies. Thus, this meta-analysis may suffer from "publication bias" in that all unpublished or working papers are not included. If publication bias results in papers with smaller and insignificant WTP estimates failing to be published despite using rigorous methods, then meta-analysis will overstate the degree of variation in WTP measures. I choose to err on the side of including only results that have been approved by a journal's peer review process.

There is a significant literature regarding WTP for organic foods and how different consumer segments differ in their WTP. In these papers a WTP value is calculated where various socio-economic and consumer demographics are used as class predictors, and the focus is generally to explain why certain classes of consumers are willing to pay more for organic foods in relation to other classes. While these papers are interesting and do shed light as to what consumer characteristics affect the WTP for organic foods, this paper is focused on how WTP estimates differ across papers, not across consumer classes. Thus, these studies were not included in this analysis because it is unclear as how to average the class WTP results to give a general WTP effect and how to equate classes between different studies. It is likely that a simple or weighted average of effects across classes would not accurately reflect the true WTP of the population because the average of results does not necessarily equal the result of the average.

The second criterion for inclusion is the reporting of a standard error, standard deviation, significance statistic or confidence interval for the WTP estimate. All papers that did not report a measure of significance or confidence regarding their WTP estimate were dropped from evaluation. This criterion is critical because the variance of the WTP estimate is used as a weight in analysis. It is best practice to use the variance of the effect size as a weighting parameter as more weight should be placed upon effect sizes that have a smaller variance (Nelson and Kennedy, 2009). For many cases, only a *t*-statistic or confidence interval was available and so the corresponding standard errors were calculated as the ratio of the *t*-statistic to effect size. In other cases a statement of significance, usually at the 5% or 1% level, was given, thus an assumed *t*-statistic was used to calculate the biggest standard error given the significance level. Therefore the papers that did not provide any numeric significance data may have overstated variances according to our method and thus smaller weights in the overall analysis.

Another criterion for inclusion was the ability to calculate the percent premium within the study. For most cases a percent premium was given and for others the percent premium was calculated. It was necessary to make all papers conform to the percent premium criterion because it simplifies the analysis and allows comparison of WTP estimates across time, currency and units of measure. By doing so, comparisons between a \$1 WTP for a dozen eggs in Arkansas in 2002 and, a £2 WTP for a loaf of bread in the UK in 2008 are possible. The percent premium is calculated as (WTP for organic product/WTP or average price level for non-organic product) – 1. The average price level of the non-organic product in the study was either taken directly from the experimental design of the paper or from a source outside of the paper. In several cases sources such as the USDA or Eurostat were used to obtain an average price level. For any paper in which the percent premium could not be calculated, the paper was dropped from evaluation.

After screening all papers according to these 3 criteria, a total of 29 papers are left for evaluation (Table 2.1). Examination of Figure 2.1, which plots the premiums from the 29 papers, reveals heterogeneity in the percent premium that ranges from -0.088 to 1.035, has an average of 0.254 and a median of 0.198. Referring to the methodological and factual distinctions of heterogeneity, I code an array of variables to be tested within a meta-regression.

In this data, methodological heterogeneity comes from the data collection method and experimental design. In terms of the experimental design, one key classification identifies whether the data comes from a purchase situation that featured hypothetical or actual payment (Table 2.2). The sample data is split evenly between hypothetical (*HYPO*) and real (*REAL*) choice situations, and it is of interest to see if there is a significant difference between estimates arising from both types of data. Most literature suggests that hypothetical bias will inflate willingness to pay estimates (Harrison, 2006), though a meta-analysis of studies with side-by-side hypothetical and non-hypothetical

Authors, Publish Year	Products Under Analysis	Range of Premium
Batte, Hooker, Haab and Beaverson, (2007)	cereal	0.050 - 0.151
Contingent valuation study using probit methods with data collected in-person over 648 individuals in Ohio, USA		
Bernard and Bernard, (2009)	milk	0.161
Auction experiment using a 2-stage tobit method using data collected in-person from 154 individuals in the Northeastern USA		
Bond, Thilmany and Bond, (2008)	lettuce	0.037
Choice experiment using MNL methods with data collected from an internet survey over 1,549 individuals sampled from the USA		
Carlucci, Stasi, Nardone and Seccia, (2013)	yogurt	0.288
Hedonic price analysis using scanner data from Italy		
Chang and Lusk, (2009)	bread	0.493 - 0.587
Choice experiment using fairness models with data collected from a mailed survery over 2,484 individuals in the USA		
Chang, Lusk and Norwood, (2010)	eggs	0.260 - 0.614
Hedonic price analysis using scanner from both a national and state data from California and Texas, USA		
Didier and Lucie, (2008)	chocolate	0.145
Auction experiment using the BDM method with data collected in-person over 102 individuals in France		
Estes and Smith, (1996)	various fruits	0.140 - 1.011
Hedonic price analysis using scanner data from Arizona, USA		
Gil, Gracia and Sanchez, (2000)	multiple categories	0.076 - 0.183
Contingent valuation study using logit methods with data collected in-person over 736 individuals from Madrid and Navarra, Spain		
Griffith and Lars, (2008)	multiple categories	-0.088 - 0.766
Hedonic price analysis using national scanner data from England		
Hu, Batte, Woods and Ernst, (2012)	jam	0.00 - 0.074
Choice experiment using CL and RPL methods with data collected from a mailed survey over 1,884 individuals sampled from Ohio and Kentucky, USA		
Hu, Woods and Bastin, (2009)	multiple categories	0.072 - 0.569
Choice experiment using CL and RPL methods with data collected in-person from 2,282 individuals sampled from Kentucky, USA		
Huang and Lin, (2004)	tomatoes	0.070 - 0.173
Hedonic price analysis using scanner data from the regional Northeasernt, Midwestern, Southern and Western USA		
James, Rickard and Rossman, (2009)	apple sauce	0.023
Choice experiment using MNL methods with data collected from a mailed survey over 1,521 individuals from Pennsylvania, USA		
Karipidis, Tsakiridou, Tabakis and Mattas, (2005)	eggs	0.23
Hedonic price analysis using scanner data from Greece		
Kim and Chung, (2011)	eggs	0.572
Hedonic price analysis using scanner data from Korea		
Kolodinsky, (2008)	milk	0.180 - 0.280
Hedonic price analysis using scanner data from the Northeastern USA		

Continued

Table 2.1 Meta Data Sources and Summary

Table 2.1 Continued

Authors, Publish Year	Products Under Analysis	Range of Premium
Krystallis, Fotopoulos and Zotos, (2006)	multiple categories	0.191 - 0.637
Choice experiment using logit methods with data collected in-person from 130 individuals in Greece		
Lin, Smith and Huang, (2008)	various fruits and vegetables	0.150 - 0.600
Hedonic price analysis using national scanner data from the USA		
Loureiro and Hine, (2001)	potatoes	0.031
Contingent valuation study using probit methods with data collected in-person over 437 individuals in Colorado, USA		
Maguire, Owens and Simon, (2004)	baby food	0.153 - 0.253
Hedonic price analysis using scanner data from California and North Carolina, USA		
Mondelaers, Verbeke and Van Huylenbroek, (2009)	carrots	0.0395
Choice experiment using MNL methods with data collected from a mailed survey over 527 individuals in Belgium		
Napolitano, Braghieri, Piasentier, Favotto, Naspetti and Zanoli, (2010)	beef	0.498
Hedonic price analysis using scanner data from Italy		
Olesen, Alfnes, Rora and Kolstad, (2010)	salmon	0.180
Choice experiment using RPL methods with data collected in-person in a simulated store setting over 115 individuals in Norway		
Onken, Bernard and Pesek, (2011)	strawberry preserves	-0.078 - 0.015
Choice experiment using nested logit models with data collected from a mailed survey over 1,980 individuals from Maryland and Virginia, USA		
Sanjuan, Sanchez, Gil, Gracia and Soler, (2003)	various fruits and vegetables	0.109 - 0.286
Contingent valuation study using logit methods with data collected from a mailed survey over 765 individuals from Zaragoza and Pamplona, Spain		
Schulz, Schroeder and White, (2012)	beef	0.380
Hedonic price analysis using scanner data from the USA		
Smith, Huang and Lin, (2009)	milk	0.88
Hedonic price analysis using scanner data from the USA		
Van Loo, Caputo, Nayga, Meullenet and Ricke, (2011)	chicken breast	0.336 - 1.04
Choice experiment using MNL and RPL methods with data collected from an internet survey over 976 individuals sampled from Arkansas, USA		

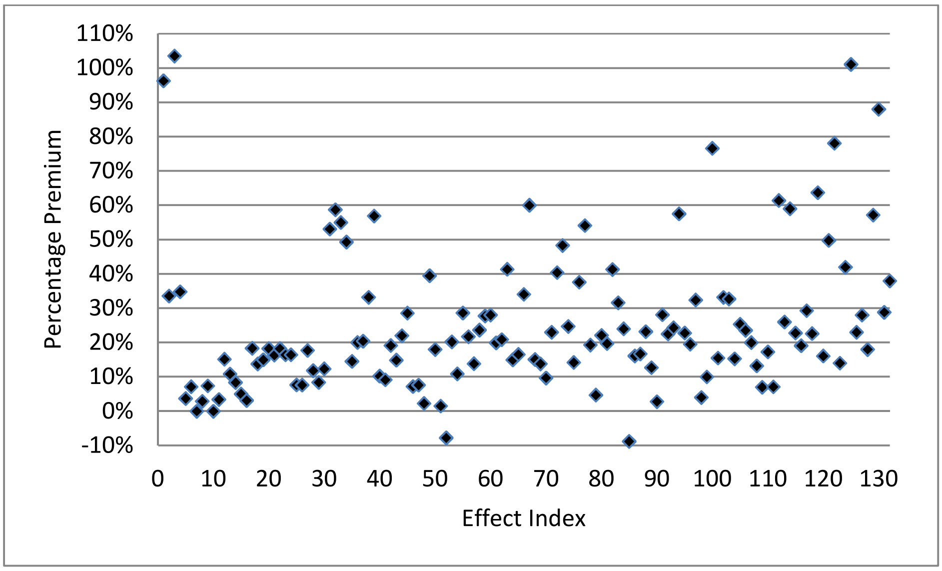

Figure 2.1 Percentage Premiums

exercises reveal little bias for items valued less than $10 (Murphy et al., 2005, pg. 321). Hence, this analysis will speak to the degree of hypothetical bias that emerges in published work on organic food products. Within the hypothetical choice data, a further distinction is made between studies that use contingent valuation (*CV*) or a choice experiment (*CHOICE*). As for choice experiments, a consumer is faced with multiple choice alternatives that differ by various attributes and makes a choice between them. The goal is to simulate a real-life situation and observe choice behavior in a controlled environment to derive WTP estimates. In contingent valuation studies consumers directly state their WTP for a given product or choose a specific WTP within a presented set. While contingent valuation studies are used across many fields of economics, especially in the valuation of non-market goods, the ability for this type of experiment to mimic a real-life situation in purchasing an organic food may be less than that of a choice

Variable	Max	Min	Average	Sum
Percentage Premium	1.035	-0.088	0.254	33.492
OBS	1,936,885	102	89,112	11,762,895
YEAR	17	0	9.886	1,305
Choice Setting				
HYPO	1	0	0.477	63
REAL	1	0	0.523	69
CHOICE	1	0	0.295	39
CV	1	0	0.189	25
Data Elicitation				
ONLINE	1	0	0.038	5
MAIL	1	0	0.152	20
INPERSON	1	0	0.303	40
SCANNER	1	0	0.508	67
Data Location and Reach				
USA	1	0	0.492	65
NATIONAL	1	0	0.485	64
Product Type				
FRUIT	1	0	0.106	14
VEGES	1	0	0.174	23
PROCESSED	1	0	0.424	56
ANIMPROD	1	0	0.295	39
Total observations = 132				

Table 2.2 Descriptive Statistics for Meta Observations

experiment. Meta-analysis comparing the formats suggests that choice experiment designs are associated with less hypothetical bias when compared to contingent valuation experiment designs (Murphy et al., 2005). Thus this study provides another assessment concerning whether estimates among organic products are systematically different between these two hypothetical elicitation formats.

Dummy variables are coded for 4 data elicitation methods: online, mail, in person and scanner (*ONLINE*, *MAIL*, *INPERSON*, and *SCANNER*). Half of the observations come from scanner data which is in line with half of observations coded as *REAL*, and the remaining papers coded *HYPO* use online, mail and in person data elicitation methods due to the typical use of surveys in hypothetical choice modeling designs. There has been considerable research regarding the influence of data elicitation methods under both hypothetical and real choice situations, and the results are unclear. A meta-review of public goods literature by Lindhjem and Navrud (2011) analyzes 17 papers that span online, mailed and face-to-face data collection methods and finds that while WTP estimates are not equal across the methods, there is no clear link between the method and the effect on WTP measurement. Lindhjem and Navrud (2011) further suggest that it is not the data elicitation method itself that causes the differences in WTP estimates, but it is more likely the underlying sample collected that drives the differences. A meta-analysis of percentage premium for non-GM food has shown that in-person survey methods result in higher WTP estimates (Lusk et al., 2005) and similar results are found in a meta-analysis of pesticide reduction (Florax, Travisi and Nijkamp, 2005). Thus, this paper will test whether the data elicitation method has a systematic influence on differences in the resulting percent premium for organic foods calculated from WTP estimates.

In terms of factual heterogeneity, I populate variables according to consumer location (US vs. Europe), the number of observations, sample representativeness (local vs. national) and year of the sampled data for each paper. Referring to Table 2.2, 49% of observations come from data sampled in the US (*USA*) and 48% come from a national sample (*NATIONAL*). We may expect significant differences between US and non-US samples and similarly we may expect differences between localized and national samples. The date of sampled data ranges from 1994 to 2011, and it is reasonable to expect differences between years as organic foods have increased in commercial availability and the number of research papers has followed suit. The number of observations per paper has the largest spread of all with a minimum of 102 and a maximum of 11,762,895 where larger samples arise from nation-wide scanner data.

The final factual source of heterogeneity in the data to be tested is the type of food that the WTP estimate and resulting percent premium is associated with. The collected data covers a wide variety of organic food products: fruits, vegetables, meat, eggs, dairy, chocolate, olive oil and wine. There are several ways in which the organic food types can be classified and coded, and in this paper we classify the products as: fruits, vegetables, processed and organic-fed, with the following descriptions.

Products coded as *FRUIT* are fruits and *VEGES* are vegetables. Products that come from animals which eat organic feed are labeled *ANIMPROD* and products that require higher levels of processing to arrive at the final good for sale are categorized as *PROCESSED.* Thus, strawberries are labeled as *FRUIT* while strawberry jam is labeled as *PROCESSED.* This distinction is made because one of the most often cited reasons for organic food purchase are consumer aversion to pesticide residue (Bond, Thilmany and Bond (2006), Hughner et al. (2007), Bonti-Ankomah, Martin and Yirode (2005)). Consumer perceptions may be that organic foods that have undergone some level of processing are more likely to contain less pesticide residue due to washing, boiling, etc. and thus they are at lower risk of exposure.

Dairy products such as milk could fall into either the *ANIMPROD* or *PROCESSED* categories because although milk can only be considered organic if it came from a cow that ate only organic feed, milk is homogenized and pasteurized by the producer before sale, and thus can be considered *PROCESSED*. I make the distinction that in the case of all dairy products including yogurt, milk, cream, cheese and butter, that they are coded as *ANIMPROD*. This is done because organic dairy products not only must come from cows that eat only organic feed, but also are free of growth hormones. Therefore, due to this additional stipulation regarding organic dairy products and potential perceived benefit to the consumer, they are classified as *ANIMPROD*.

Section 2.3 Results

A meta-regression is estimated where the dependent variable, percentage premium, is regressed upon a series of dummy variables and a time trend (*YEAR*), with results reported in Table 2.3. The meta-regression is a weighted least squares model where each observation is weighted by inverse of the corresponding variance. Due to issues of multicollinearity, not every variable of interest could be included in the model. For instance, the high correlation between *REAL* and *SCANNER* (ρ =0.909) precludes the inclusion of both variables in the model. The standard errors are calculated in three ways: unadjusted standard errors from the WLS model (presented in parentheses), robust standard errors (presented in square brackets) and robust standard errors clustered on the study from which the estimates came (presented in curly brackets). Referring to Table 2.3, the hypothesis that all explanatory variables are jointly equal to zero is rejected across all error structures and the model's R^2 = 0.8506 suggests a strong fit.

The first group of explanatory variables includes food type. These variables are jointly significant at the 10% level across all models, as shown in Table 2.4, suggesting food type as classified in this exercise influence consumer WTP for organic products. The estimated coefficients suggest the following rank-ordering for consumer WTP across organic food types: fruit, animal products, vegetables and, lastly, processed foods. While fruit has the highest estimated premium, it is measured with low precision (standard errors = 0.0868, 0.1543 and 0.1608 for standard, robust and robust clustered methods respectively). As such, it is not statistically different from animal products for all models

Variable	Coefficient	*p*-value
ANIMPROD	0.0829	
	(0.0400)**	0.0402
	[0.0559]	0.1408
	{0.0899}	0.3583
PROCESSED	-0.0661	
	(0.0449)	0.1437
	[0.0427]	0.1244
	{0.0415}	0.1137
FRUIT	0.1621	
	(0.0868)*	0.0640
	[0.1543]	0.2954
	{0.1608}	0.3152
YEAR	0.0321	
	(0.0060)***	0.0000
	[0.0116]***	0.0064
	{0.0185}*	0.0843
CV	0.1972	
	(0.0894)**	0.0292
	[0.0764]**	0.0110
	{0.1030}*	0.0577
CHOICE	-0.0521	
	(0.0560)	0.3542
	[0.0568]	0.3606
	{0.0485}	0.2845
NATIONAL	0.2483	
	(0.0209)***	0.0000
	[0.0490]***	0.0000
	{0.0290}***	0.0000
INPERSON	-0.0825	
	(0.0777)	0.2905
	[0.0317]**	0.0104
	{0.0437}*	0.0615
Constant	-.2528	
	(0.0722)***	0.0006
	[0.1299]*	0.0537
	{0.1966}	0.2007

obs. =132
* = 10% significance, ** = 5% significance, *** = 1% significance
R-squared for all error structures = 0.851
Joint Significance F-tests are significant for all error structures with p-values<0.001

Table 2.3 Meta-Regression Results

though it is significantly larger than processed foods ($F = 6.62$, $p = 0.011$) and vegetables ($t = 1.869$, $p = 0.0640$) under OLS errors at the 10% confidence level.

Perhaps the most compelling comparison for fruits is to vegetables, as the two products are often subject to similar levels of processing and handling and broadly meet similar nutritional requirements and roles within meals. The higher WTP for fruit may stem from the fact that fruits are more often consumed without much additional preparation by the consumer, while vegetables may often be cooked or further processed by the consumer prior to consumption. The level of imprecision associated with fruit may stem from consumer perceptions that simple washing can mitigate some of the negative effects associated with non-organic fruit, i.e., a perception that thorough washing of non-organic fruit may suffice to deliver protection against the consumer health concerns like pesticide residues that organic produce delivers.

	Unadjusted Standard Errors		Robust Standard Errors		Robust Clustered Standard Errors*	
Hypothesis	F	*p*-value	F	*p*-value	F	*p*-value
ANIMPROD=PROCESSED=FRUIT=0	5.26	0.0019	2.25	0.0585	2.88	0.0535
ANIMPROD=PROCESSED	10.92	0.0012	6.74	0.0106	4.33	0.0467
ANIMPROD=FRUIT	0.77	0.3832	0.28	0.5978	0.27	0.6071
PROCESSED=FRUIT	6.62	0.0113	2.18	0.1423	1.9	0.1795
CV=CHOICE	6.70	0.0108	6.88	0.0098	3.85	0.0598

*Robust standard errors clustered by study

Table 2.4 Meta-Regression Hypothesis Tests

Animal products feature the second highest WTP among food categories with an average premium of 32.4%. This is significantly larger than the base group of vegetables

($t = 2.071$, $p = 0.040$) under OLS errors and consistently larger than processed foods across all methods of standard error calculation at the 10% level. Animal products may garner a higher WTP than vegetables and processed foods due to animal welfare concerns and due to a perception that animal products may concentrate perceived impurities generated by non-organic animal production processes. Finally, processed foods feature the lowest WTP across categories, yet it is not statistically different from vegetables regardless of the type of standard error used. Given that many of these products may feature a mix of organic and non-organic ingredients, a lower WTP is not surprising.

The next set of explanatory variables explored involve whether a study's incentives were real or hypothetical. The model is estimated using *REAL* as the omitted case and parameters are estimated for *CV* and *CHOICE*, thus we are comparing hypothetical choice situations with real choice situations, and comparing across the two segments within the *HYPO* choice set. Within the *REAL* segment, 3 papers are choice experiments or contingent valuation studies that use a binding payment, and a total of 4 observations coded as *CV* or *CHOICE* are subsumed into the omitted case of *REAL*. The coefficient on *CV* is positive and significant and is statistically different from *CHOICE* across all forms of standard errors. This result supports the idea that contingent valuation studies generally inflate percentage premium estimates in comparison to other experimental designs. *CHOICE* is not statistically different from zero across all models implying that results do not significantly differ between papers that use data from choice experiments and papers using scanner data, however, as noted by Murphy et al. (2005) the area where hypothetical bias is least likely to arise is with market goods valued at less than $10, which is the case for most organic food items in the quantities considered in these studies.

Due to an issue of multicollinearity, *SCANNER* is subsumed into *REAL* and remains as an omitted case in the data elicitation category. Similarly, if *INPERSON*, *MAIL* and *INTERNET* were all included as independents in the model, we would achieve perfect multicollinearity, so *INPERSON* was selected for inclusion and *MAIL* and *INTERNET* omitted. The negative coefficient on *INPERSON* is not significant when invoking simple standard errors and we cannot reject the null hypothesis. However, *INPERSON* is significant under robust errors at the 5% level and robust-clustered errors at the 10% level. Thus, when looking at the 3 data elicitation methods, we see systematic differences when we account for correlations between unobservables that come from the same paper. Under the category of sample representativeness, *NATIONAL* has a positive and significant coefficient across all forms of standard errors at the 1% level, indicating that percentage premiums are higher when national data samples are collected rather than localized data samples. This result may stem from the fact that national studies have much larger sample sizes resulting in smaller variances (national average variance = 0.012 non-national average variance = 0.022), and thus larger weights than smaller localized samples. This result may also come about from national samples being prohibitively expensive for survey-based research, and thus smaller, local samples are used which may be non-representative of the total population. Thus, if local samples are non-representative of larger national trends, and receive smaller weights, then we may expect percentage premiums to be lower if national trends are naturally higher. Looking into previous meta-regression research, there is little to be said regarding the impact of national versus local samples in meta-regressions, thus it is unclear if the result in this paper is representative of a natural trend in the research or is particular to these data sets. In any case, it suggests that future meta-regression work investigate the degree of representativeness of the sample data.

Lastly, the time trend *YEAR* has a positive and significant coefficient for all models, so we can expect percentage premiums for organic foods to be lower in the past. This result may be due to customer perceptions changing over time or possibly due to more data being available for analysis. As noted earlier, organic foods have been increasing in: accessibility to consumers, the number of products available for consumption and as a share of agricultural markets around the world. As such the market for organic foods has been expanding, and so the WTP for organic foods may be increasing due to new consumers entering the market over time, more products being available as organic, not just fruits and vegetables, and from existing organic food consumers who have stronger preferences for organic foods.

Section 2.4 Conclusion

After a literature search and multiple criteria fitting, 29 articles yielding 132 observations were used to regress multiple paper characteristics on the percentage premium for organic foods. Both factual and methodological sources of heterogeneity were tested for significance within the meta-regression. A decomposition of variance using the Shorrocks-Shapley method shows that variables associated with factual heterogeneity including food type, year of study and sample representativeness, jointly account for 63.5% of the explained variance in percentage premium, while variables associated with methodological heterogeneity including data elicitation method and experimental design, jointly account for 36.5% of the explained variance in percentage premium. Thus factual heterogeneity dominates as the source of heterogeneity in the results examined in this study. The type of organic food under analysis has a significant effect on the percentage premiums on organic foods, independent of all other estimated sources of methodological heterogeneity. We also find that samples using data with a national scope have higher estimates of the percentage premium for organic foods and that structuring the standard errors to allow for correlations within papers affects the significance of explanatory variables.

When we look to the extant literature that estimate a consumer's WTP or percentage premium for organic foods, we must be cognizant of the food type under evaluation and scope of the data sample, otherwise we may be making misleading comparisons across different studies. Future researchers looking at the evolution of WTP and percentage premiums for organic foods may want to test for non-linear time trends in the data. As more and more products become labeled as organic and organic purchases become ever more common the organic market may become saturated, we may expect preferences to stabilize and the WTP and percentage premiums for organic foods to level off.

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Appendix A: Sample Experiment

Sample Experiment:

If you were to buy one package of breakfast cereal, which would you select?

Cereal product 1	**Cereal product 2**	**Cereal product 3**	
Made with Organic Grains	USDA ORGANIC	USDA ORGANIC *100% Organic*	
Processed and packaged in the US with grains grown in England	Processed and packaged in China with grains grown in China	Processed and packaged in the US with grains grown in the US	**NONE: I would not choose any of these**
Environmentally Friendly			
$ 3.60	**$ 2.60**	**$ 4.40**	

Choose by clicking one of the buttons above.

Figure A1 Sample Experiment